



Installation and maintenance manual for KLMOD air-handling units



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Contents

1.	GENERAL INFORMATION	3
2.	SAFETY GUIDELINES.....	4
3.	TRANSPORT, PACKING, STORAGE	5
3.1.	SCOPE OF DELIVERY.....	5
3.2.	TRANSPORT AND PACKING	5
3.3.	TRANSPORT AND HANDLING OF ENERGY RECOVERY WHEEL.....	6
3.4.	TAKING OVER.....	7
3.5.	STORAGE	7
4.	ASSEMBLY AND INSTALLATION	8
4.1.	STARTING ASSEMBLY.....	8
4.2.	TECHNICAL SPECIFICATION GLOSSARY	8
4.3.	LABELING OF SECTIONS (SHIPPING SPLIT)	12
4.4.	MINIMUM CLEARANCE DISTANCES	12
4.5.	BASE FRAME, DIMENSIONS OF BASE PLINTH, ANTI-VIBRATION MOUNTINGS	13
4.6.	CONNECTING SECTIONS - GENERAL INFORMATION.....	14
4.7.	TRAP INSTALLATION	22
4.8.	ROOF COVER INSTALLATION.....	25
5.	SECTIONS STARTUP	27
5.1.	DAMPERS.....	27
5.2.	FAN WITH FREE IMPELLER (PLUG-FAN)	28
5.2.1.	MOTOR'S ELECTRICAL CONNECTION THROUGH FREQUENCY MODULATOR	29
5.3.	V-BELT DRIVE FANS	31
5.3.1.	DIRECT WIRING OF MOTORS TO POWER SUPPLY LINE – with the exclusion of frequency modulator.....	33
5.3.2.	ELECTRICAL CONNECTION OF V-BELT DRIVE MOTORS USING FREQUENCY MODULATOR	35
5.4.	FANS WITH EC MOTORS	36
5.5.	FILTERS.....	38
5.5.1.	Diagrams of filters' layout for various sizes of KLMOD units.....	39
5.6.	HYDRONIC HEATING EXCHANGERS.....	43
5.7.	ANTIFREEZE PROTECTION	45
5.8.	STEAM HEATER.....	45
5.9.	ELEKTRICAL HEATER	46
5.10.	GAS-FIRED HEATER.....	47
5.11.	HYDRONIC COOLING EXCHANGER	50

5.12.	DIRECT EXPANSION (DX) EVAPORATOR	51
5.13.	ENERGY RECOVERY WHEEL.....	52
5.14.	CROSS-FLOW HEAT RECOVERY EXCHANGER	55
5.15.	HEAT RECOVERY GLYCOL CIRCUIT	56
5.16.	NOISE ATTENUATING SECTION.....	56
5.17.	DISPERSE HUMIDIFICATION SECTION (AIR-WASHER)	57
5.18.	EVAPORATING HONEYCOMB HUMIDIFIER.....	59
5.19.	STEAM HUMIDIFICATION SECTION	59
6.	REGULAR MAINTENANCE	60
6.1.	DAMPERS	60
6.2.	FAN WITH FREE IMPELLER (PLUG-FAN)	60
6.3.	V-BELT DRIVE FANS	60
6.4.	FANS WITH EC MOTORS	61
6.5.	GAS-FIRED HEATER.....	61
6.6.	HYDRONIC HEATING EXCHANGER.....	62
6.7.	ANTIFREEZE PROTECTION	62
6.8.	STEAM HEATER.....	62
6.9.	HYDRONIC COOLING EXCHANGER	62
6.10.	DIRECT EXPANSION (DX) EXCHANGER	63
6.11.	DISPERSE HUMIDIFICATION SECTION (AIR-WASHER)	63
6.12.	EVAPORATING HONEYCOMB HUMIDIFIER.....	63
7.	WARRANTY	64
8.	DISPOSAL.....	65
9.	ANNEXES.....	65
9.1.	V-belt transmission sheet - EXAMPLE	66
9.1.1.	Indicative values of V-belts temporary tensioning	66
9.2.	DISASSEMBLY AND RE-ASSEMBLY	67
9.2.1.	Pulley disassembly.....	67
9.2.2.	Pulley re-assembly (Taper-Lock® system).....	67
9.2.3.	Checking pulleys' abrasion	67
9.2.4.	Disassembly and assembly of free impeller.....	67
9.3.	DISPERSE HUMIDIFICATION SECTION (AIR-WASHER)- water properties.....	70
9.4.	Warranty claim sheet	71
9.5.	CERTIFICATE OF CONFORMITY.....	Chyba! Záložka není definována.
9.6.	CERTIFICATES.....	Chyba! Záložka není definována.

1. GENERAL INFORMATION

- The installation, operation and maintenance manual for series KLMOD indoor and outdoor air-handling units is intended in particular for the operating / service personnel. The manual includes technical information, health and safety cautions, instructions for taking over, shipping and handling, assembly and installation, operational information, maintenance information, repair suggestions, storage, list of components that are subject of wear and tear, decommissioning and disposal information and warranty information.
- It is imperative to adhere to the information presented in this manual to realize safe, reliable and efficient operation of the product.
- The air-handling units have been designed to carry and treat air in low-pressure and medium-pressure ventilation, heating and air-conditioning systems in non-explosive environment with the temperature of ambient air ranging from -30°C to +40°C. The outdoor air-handling unit models have been designed for use in outdoor environment exposed to direct action of weather effects.
- Air flowing through the fans must not contain any mechanical particles, fibrous dust or any foreign substances that might accumulate in the impeller or spiral box or cause excessive corrosion of steel, aluminium or zinc.
- **The maximum air temperature** drawn through the fan is **40°C**.
- **The maximum air humidity** drawn through the air-handling unit is 17g/kg (80% at 25°C).
- Outdoor models of the unit have to be equipped with a roof cover shielding the air-handling unit from the action of rain and snow.
- If the relative humidity of the outdoor air on suction side reaches 100% (wet steam) as a result of the actual climatic conditions, it is at the discretion of the operator whether he continuous running the unit taking the risk of possible temporary water condensation on the interior parts of the unit (e.g. filters, dampers etc.). Damage caused by the condensate and the humidity cannot be claimed under the warranty conditions.
- The unit's casing has been produced to comply with a specific class of tightness (in compliance with the filtering class employed). This implies, however, that the unit is neither gas-proof nor waterproof.
- Technical data of the ventilation system and its components connected to the units, control devices and electrical wiring has to be included in the execution design documentation.

WARNING SYMBOLS AND SAFETY LABELING

Three types of warning symbols have been applied in this manual:



This symbol flags up danger of serious health and safety risks. All the time adhere to the instructions presented under this danger warning. At the same time all the health and safety regulations and directives in force must be observed.



This symbol indicates an important instruction or work procedure, infringement of which may lead to serious damage of some parts of the air-handling unit.



This symbol indicates instruction or recommendation important for correct or efficient operating of the equipment.



2. SAFETY GUIDELINES

- Service, cleaning, maintenance and repairs of the product can only be performed by competent and trained personnel following instructions issued by authorized employee.
- Special attention must be given to safety warnings and cautions. Failure to comply with any of these requirements could result in serious damage to the equipment and the property, in which it is situated, as well as severe personal injury or death to themselves and people at the site.
- The user of the product is obliged to train, or organize training for the personal appointed to operate and maintain the product. Furthermore, the user is responsible for making the personnel acquainted with this manual and all standards and regulations related to the product's operation, in particular with applicable health and safety regulations.
- It is essential to observe the valid health and safety regulations and generally accepted technical rules when assembling the unit, completed in-field electrical wiring, start-up, repairs and service works.
- Only authorized personnel or firm with valid legal authorization can perform assembly of the unit, including the wiring of electrical installations, commissioning of the unit and carry out repairs, service and maintenance works.
- The unit must be isolated from the electric voltage supply during checks, cleaning and repairs. The supply of system fluid to the coils must be closed off. Works on the water heaters can only be started after they cool down to at least +40°C.
- Heat exchangers can be used only under the operation conditions for which they have been designed. During the stoppage of fan operation, system fluid supply into the exchanger must be blocked off.
- When discharging system fluids from the heat exchangers, the temperature of the fluids must be less than +40°C.
- Fans are installed on flexible anti-vibration mountings. Power cabling and grounding conductors must not prevent the fans from unobstructed movement. To achieve this, the cabling is to be looped for instance.
- Fans may be started only when service panels or built-in protective shields are closed / installed.
- Factory identification plates and warning labels must be kept in good condition and clean during the whole unit's service life. Be careful during cleaning of the unit, solvents may damage the plates!
- Units must not be operated under conditions other than those for which they have been designed. The manufacturer is not responsible for any incurred losses caused by improper use of the units. The user bears the responsibility and full risk for incorrect operating of the unit.
- Unit's sections or the whole unit can only be lifted by forklifts or cranes using lifting slings during the transport and handling strictly observing the requirements of Czech code ČSN 27 0144. The heat exchangers must not contain any system fluid during the transport or handling.
- Changes, amendments and modifications to the unit that may have any influence on its safe operating must not be performed without the manufacturer's permission.
- The directions stipulated in this manual must be observed when operating the units. The conditions of use agreed with the manufacturer for atypical units must be observed.

3. TRANSPORT, PACKING, STORAGE

3.1. SCOPE OF DELIVERY

- Complete product (packed, dry - no corrosion signs) corresponding to the order placed
- Delivery note (freight bill) including list of parts supplied
- Accompanying technical documentation placed in self-adhesive plastic pocket attached to the access door of the fan section including:
 - Technical specification sheet of the unit's assembly
 - Technical data sheets of the V-belt drives if V-belt drive fans are applied
 - This installation, operation and maintenance manual
- The technical documentation for other equipment supplied along with the unit is placed in self-adhesive plastic pocket and attached to the top panel of the respective section. It includes:
 - o Electric heaters – installation and operation guidelines and wiring diagram
 - o Gas burners - technical information, assembly instructions and schematic diagram of burner's connections, certificates, operation rules
 - o Humidification section - diagram of connections, operating rules

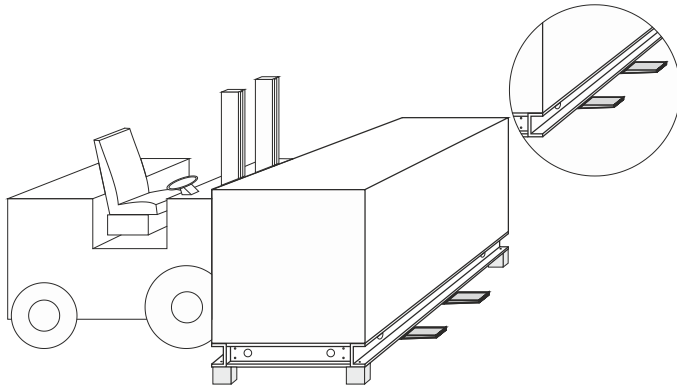
Full set of technical documentation related to installation of series KLMOD air-handling units has been published on our websites www.janka.cz

3.2. TRANSPORT AND PACKING

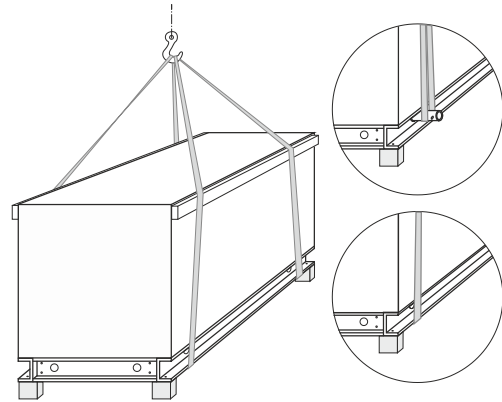
- The units are typically shipped unassembled in a form of multiple shipping splits (sections) or partly assembled with sections attached to the base frame.
- Metal-sheet roof covers for outdoor models are pre-installed on the units.
- All units/shipping splits are supplied wrapped in plastic foil.
- Unit's surface is dry, without white corrosion on the zinc-coated finishes upon delivery.
- The carrier must ensure that the unit is shipped in an enclosed, dry space protected against rain and snow.
- Fan sections are equipped with red coloured shipping brackets, which protect the flexible fan mountings from damage during transport; for more details see the chapter Fans.
- The shipping splits (sections) or the whole unit may be lifted only by forklift or by crane using lifting slings. The Czech code ČSN 27 0144 must be observed.
- The heat exchangers must not contain any system fluid during the transport or handling.
- Move or lift the sections only through the base frame at the bottom. Forks of the forklift have to be adequately long in order to support the base frame on both sides. If too short forks are used, the forks do not support the base frame on both sides, but lean against unit's bottom panels. This would lead to distortion or perforation of the unit's bottom panel. Pull lifting slings under the unit or slip them over a steel bar that is pulled through openings in the base frame (Fig. 2).
- NEVER lift the sections or the unit by slings laced directly through the openings in the base frame. However, lifting by means of a steel bar pulled through the openings in the base frame is possible.
- The pressure forces induced by slings on the unit's side panels during lifting has to be spread by a wooden balk. Otherwise there is a risk of damage to the housing or roof edge (Fig. 2). Heavier pieces (over 300kg) have to be lifted by spreader bar to prevent damage to the unit's housing (Fig. 3).
- Metal-sheet roof covers are pre-installed on the outdoor units. In order to prevent damage to the drip moulding on the roof cover edges, the outdoor models have been shipped with wooden balks at the top (Figure 4). These wooden balks including their fasteners have to be removed after the handling procedure of the unit is finished.



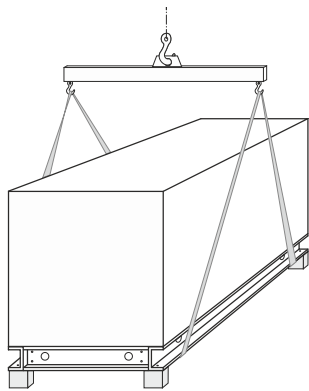
Recommended ways of rigging and handling



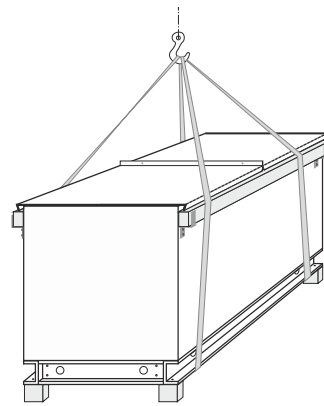
Lifting and handling by forklift



Lifting by crane - lifting slings



Rigging of heavier units by spread bar

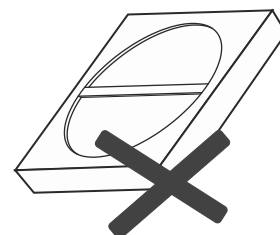
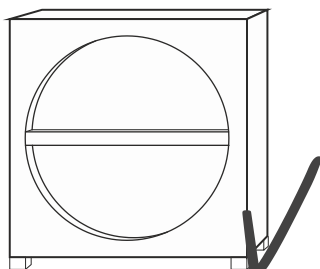


Outdoor units come equipped with wooden barks along the long sides protecting the pre-installed roof cover edge

3.3. TRANSPORT AND HANDLING OF ENERGY RECOVERY WHEEL



- Pay special attention to transport and handling of heat recovery wheel, as the heat recovery wheel section is very unstable due to its particular shape (high and narrow) and heavy weight.
- The energy recovery wheel may be stored, shipped and handled only IN VERTICAL POSITION.
- Tilting or putting down the heat recovery wheel in horizontal position may lead to irretrievable damage to the wheel. Damage caused in such improper handling cannot be claimed under the warranty condition. The heat transmission face of the wheel comprises of thin corrugated reeled-up aluminium sheets and is therefore very fragile and prone to damage.
- It is highly recommended securing the heat recovery wheel section very cautiously from falling during transport and storage.



3.4. TAKING OVER

Upon receipt the delivered equipment must be checked for following items:

- Compliance with the agreed design model and agreed quantity according to the information in the delivery note
- Any damage during shipment
- Condensed water or water drops under the shipping plastic foil wrapper. Such moisture under the plastic foil wrapper is undesirable and must be removed. Unwrap and dry up the equipment. Should be the equipment stored further on, a new wrapper must be applied and the equipment must be stored in compliance with paragraph 3.5.

In case of damage in shipment, the receiver is responsible for:

- Recording the extent of damage caused in shipment on the delivery note or the international CMR shipping sheet
- Always taking photographs and sending the photos
- Failure to comply will void any claim against the shipping company

3.5. STORAGE



- Storage of the units must be in dry and dustless areas with ambient temperature above +5°C. The units must be protected from mechanical damage, construction dirt, debris and corrosion attack caused by permanent water condensation on unit's surface. The equipment must be protected from rain, snow and other weather action during storage.
- Storage maintenance at the receiver's site includes rotation of fan's and motor's shaft at least every two weeks to ensure greasing of the bearings protecting them from corrosion.
- Units with zinc-coated metal sheet casing must be unwrapped shortly after receipt on the site of installation (remove the shipping foil). Failure to follow this guideline will lead to water condensation on unit's surface under the foil causing white corrosion on the zinc-coated casing panels due to differences in temperature and air humidity. The white corrosion is only an esthetical flaw occurring on the surface of zinc-coated sheets and does not compromise their mechanical properties in any manner.

4. ASSEMBLY AND INSTALLATION

4.1. STARTING ASSEMBLY

- Only authorized personnel or a licensed company holding valid authorization certificate may perform the unit's assembly. Warranty is void if the assembly was performed by unauthorized personnel.
- Assembly or technical supervision during assembly can be ordered from the manufacturer.
- It is possible that some components of the unit may become loose during shipment. Therefore we recommend tightening the bolts holding the motor and stretcher. We also recommend checking tightening of mainly the rotary parts (in particular the pulleys) before the start-up.
- The wiring and grounding of the electrical equipment, motors and the entire electrical installation must comply with the valid electrical standards, especially ČSN 33 2190, ČSN 33 2000-4-41, ČSN 33 2000-5-51, ČSN 33 2000-5-54. Furthermore, the wiring and grounding set-up has to be adequate to comply with the ambient conditions with regards to the safe operation. Only authorized personnel or a licensed company holding valid authorization can perform the works on electrical installations.
- Air handling units' sections must not be used for supporting footbridges or electrical cabling, steel profiles, distribution panels etc. Non-compliance with these stipulations will make the warranty void.
- It is necessary to check whether the unit was stored in accordance with the required storage conditions presented in paragraph 3.5 prior to the assembly. It is necessary to remove all shipment brackets and holders before assembling. Fan sections are equipped with red coloured shipping brackets, which protect the flexible fan mountings from damage during shipment. These red shipment brackets must be removed before the unit is put into operation!
- It is recommended to use protective glasses and gloves during assembly works and handling the unit.
- Observe the rules and recommendations set out above in the paragraph 3.2. during handling and lifting.
- Warning: The air-handling unit must not be lifted overhead.
- The lifting lug on the motor is intended only for lifting the motor during assembling and disassembling
- A rain-protective cover with a safety grille preventing suction of water droplets and foreign particles into the unit has to be installed at the air intake side and in some cases at the air exhaust side of the outdoor units'
- The unit's structure has a limited bearing capacity and definitely has not been designed for storage of any objects, especially heavy weight objects. This may cause distortion of unit's casing (panels) or serious damage. Such damage is not subject of the warranty terms. Furthermore, unit's distortion obstructs subsequent installation of the protection roof cover on outdoor units.



4.2. TECHNICAL SPECIFICATION GLOSSARY



The technical specification of the equipment comprises of a folder with technical documents shipped together with the equipment. The folder is attached to the access door of the interior air-intake fan section. The technical documents contain detailed technical description of the equipment delivered.

Following information can be found in the technical specification:

- Job number of the order and equipment number
- Schematic diagram of the unit's assembly with identification numbers of each section
- Performance parameters of the unit
- Detailed technical description of each section of the unit's assembly
- Performance curves of the fans with operating points shown
- Elevation and layout plans of the unit's assembly

In addition to the above, also transmission data sheets of the fans' drives are provided for units with V-belt drive.

TECHNICAL SPECIFICATION - page 1

Identification
numerical code of the
unit and name of the
project

Size of the unit and
airflow performance

Casing design and
color

Design model of the
unit
(indoor / outdoor/
hygiene / explosion-
proof....)

Length and weight of
shipment split

Number of the section
as shown in the
specification

Air-flow direction
FA – fresh air
SA- supply air
CA- re-circulation air
RA- return air
EA – exhaust air

Removable service
panel

Extra accessories

Total weight

Klimatizační jednotka

CLIMACAL
Version 8.0.2
A9I9W4T2HK8THR6

PremiAir
Flexible Solution - Effective Way

JANKA
ENGINEERING

přívod AHU
Strana 1

Pozice v projektu
Číslo nabídky

Zař. 1-přívod
AH-14-0100

Odběratel
Projekt Montážní hala

Datum
9.5.2014

Technické údaje

Velikost jednotky

KLMOD 12

Opláštění

Průtok na přívodu

10500 m³/h

Tloušťka panelu

0,6mm ext./0,6mm int.

Externí tlak

2,92 m³/s

Vnitřní

Rychlost ve volném průřezu

300 Pa

Vnější

Lakovaný (RAL 9002)

Typ jednotky

2,5 m/s

Kostra

Hliník

Nadmořská výška

Vnitřní jednotka

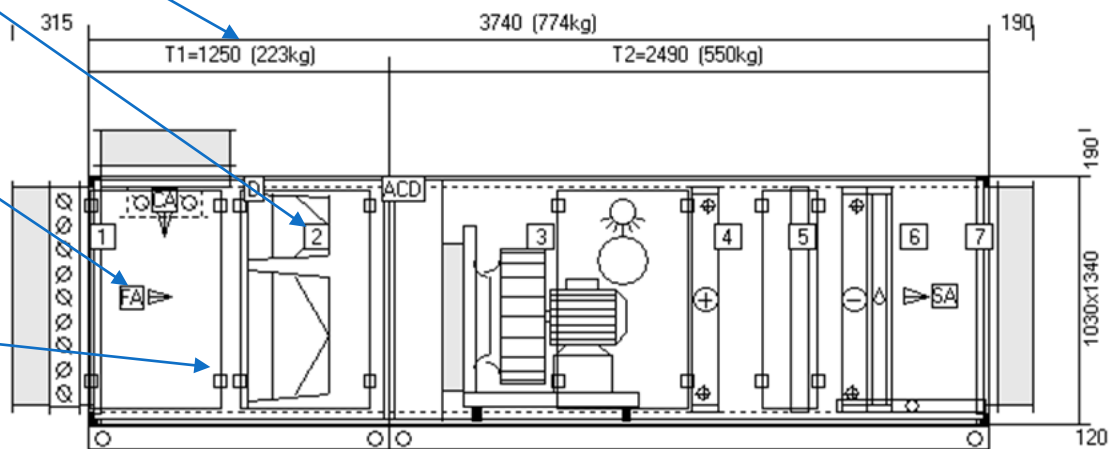
Izolace

PUR pěna / 50 mm

100 m

Jazyk dokumentace

Česky



Nárys

A.....Okno

C.....Světlo 230 V

D.....Průchodky pro tlaková čidla

Jednotka s rámem

Celková hmotnost: 774 kg

TECHNICAL SPECIFICATION – continuation

Identification of shipping split (delivered as one piece) length and weight

Numerical code of the section – see the picture

Type of filter applied and filtering class

Dimensions, number and ordering code of filters

Rated power output of the fan's motor

Operating frequency and maximum frequency for the application given

Sound power through casing

Sound pressure at 2m from casing

Sound power at air intake damper side

Sound power at re-circulation damper side

Sound power at air exhaust form the unit

Accessories

Performance parameters of the exchanger coil (heater)

Transportní sekce 1

Délka: 1250mm Hmotnost: 223 kg

L=0mm S=0mm D=0mm

(1) Směšovací komora

Čerstvý vzduch	Klapka	Čelní celoplošná vnější	Standardní klapka	910x1220mm						
Max. průtok		10500 m ³ /h	Tlaková ztráta	6	Pa	Ovládací moment	8	Nm		
		2,92 m ³ /s								

Příslušenství - 1x Manžeta 900x1240mm

Cirkulační vzduch Klapka Horní úzká vnitřní Standardní klapka 310x1040mm

Max. průtok		10500 m ³ /h	Tlaková ztráta	74	Pa	Ovládací moment	4	Nm		
		2,92 m ³ /s								

Příslušenství - 1x Manžeta 540x620mm

L=210mm S=0mm D=0mm

(2) Filtr

Údaje o filtru			Údaje o proudění							
Typ	Krátký kapsový filtr zasunovací		Průtok	10500 m ³ /h		Vyložení filtrů	2 (550 354)			
				2,917 m ³ /s			2 (550 364)			
Třída filtrace	G4		Poc./ Max. tl. ztr.	35/250 Pa						
Čelní plocha	1,04 m ²		Vyp. tlak. ztráta	142 Pa						
Délka filtru	360 mm									

Příslušenství - 1x Průchodky pro tlaková čidla (pár)

Transportní sekce 2

Délka: 2490mm Hmotnost: 550 kg

L=20mm S=0mm D=0mm

(3) Přívodní ventilátor

Údaje o ventilátoru			Údaje o motoru							
Velikost	D 560 P Std.		Výkon	4 @						
Lopatky	Plug Fan			OP 3,41 kW						
Izolatory	Pryž		Napětí	400/690V-3ph-50Hz						
Otáčky	1571 ot/min		Krytí	IP55 Termistory						
Účinnost	79 %			(A11)						
Příkon	3,09 kW		Prov./Max. Frekv.	54/59 Hz						
			Otáčky nom./max.	1455/1710 ot/min						
			Jmenovitý proud	8,2 @						
				OP 7,3 A						
			Kód motoru	112.4.B3.4kW.S.S (340199)						

Hladina ak. výkonu	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Celkem	
Lw opláštění	39	50	54	54	51	50	42	34	59	dB(A)
Lp*	22	33	37	37	34	33	25	17	42	dB(A)
Lw Čerstvý vzduch	46,5	59	66	71	71	67	62	55	76	dB(A)
Lw Cirkulační vzduch	44,5	57	65	70	70	66	61	54	75	dB(A)
Lw Přívodní vzduch	49,5	63,5	74,5	80,5	79,5	75,5	70,5	63,5	84	dB(A)

*Hladina akustického tlaku vypočtená ve vzdálenosti 2 m (pro volné pole)

Příslušenství

- 1x Okno
- 1x Světlo 230 V
- 1x Průchodky pro tlaková čidla (pár)
- 1x F.M. 4kW 3x400V 9,1A (IP54) s LCP panelem (ID Basic drive - 912031)

L=120mm S=0mm D=0mm

(4) Ohřivač

Údaje o výměníku			Připojení Pravé							
Typ	Výměník "C"		Údaje o proudění							
Materiál	Cu/Al		Průtok	10500 m ³ /h		Údaje o médiu				
				2,917 m ³ /s		Typ	Voda			
Rychlost na vým.	3 m/s		Vstup vzduchu	-15/90 °C/%r.H.		Glykol	0 %			
Řad/okruhů	3/26		Výstup vzduchu	25/5 °C/%r.H.		Vstup/výstup	80/60 °C			
Roztec lamel	2,54 mm		Bezpečnostní koef.	14 %		Průtok	6090 kg/h			
Připojení	DN32 Zvenku		Celkový výkon	141,9 kW		Tlaková ztráta	12,1 kPa			
			Tlaková ztráta	63 Pa						

L=0mm S=0mm D=0mm

(5) Protimrazová ochrana

L=0mm S=0mm D=0mm

TECHNICAL SPECIFICATION – fans' performance curves

Identification
information of the fan
and size of the
impeller

Přívodní ventilátor D 560 P Std.

Performance curves
of motor's rated
output

Operating
characteristics

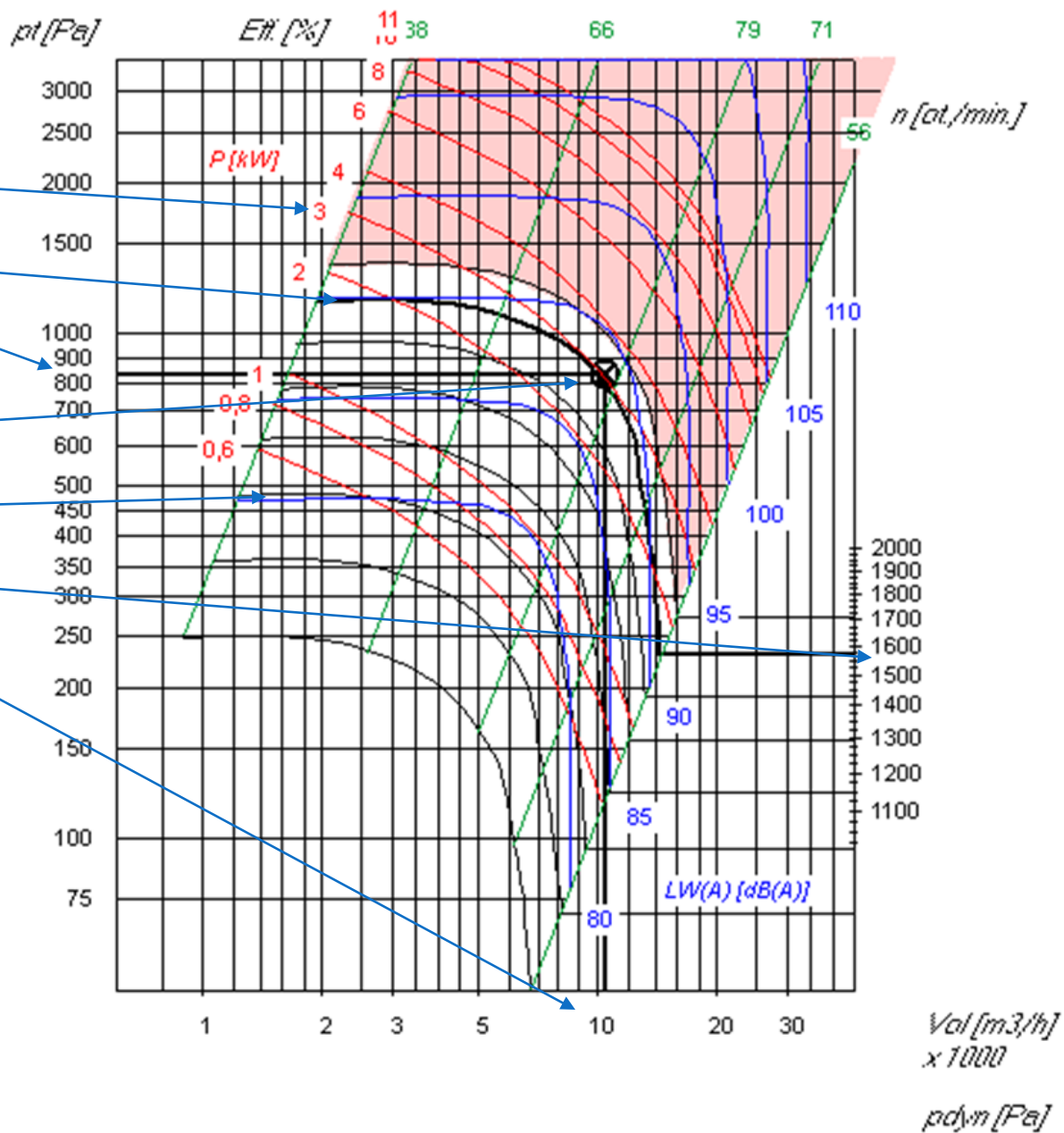
Total pressure of the
fan

OPERATING POINT

Sound pressure curves
 $L_w(A)$

Revolving speed of
the impeller

Air flow performance



4.3. LABELING OF SECTIONS (SHIPPING SPLIT)

Each shipping split (section) of the air-handling unit comes provided with an identification label. Pay particular attention to the information furnished on the bottom line of the label when assembling the unit. The bottom line shows identification number of equipment within the job and identification number of shipment splits (sections), which is identical with the identification of the shipment splits (sections) presented in the technical documentation. The serial number is important for back tracking of the job in the future if spare parts are required. Keep the identification labels clean and legible; do not use solvents for cleaning.

Size of the unit, color, type of base frame, identification codes of devices used inside the unit

Serial number of the speciation / customer number / item in the system

Corporate code KLMOD

Job number Janka

Month / Year of production

Numerical code of the equipment as provided in the specification/
numerical code of section as provided the technical specification

			
TYP: KLMOD49-2170P P RAM C120 E PGF100-PRUZ ISOL E PPP			
Výrobní č.: 20256796/AHU0004/14/18		Hmotnost: 1 075 kg	
Norma: PK 12 7449		Osvědčení č.: C5a-09-0486	
Zakázka č.: AHU0004/14		Rok výroby: 04/2014	
Max.provozní přetlak:		2 000 Pa	Medium: Vzduch
Max.provozní teplota:		40 °C	
Zařízení č. AHU 1.1B /3,			

4.4. MINIMUM CLEARANCE DISTANCES

In case the unit is installed inside a machine room, sufficient clearance around the unit must be allowed to ensure convenient maintenance and service works. Allow clearance distance of 600mm from the rear side of the unit if exterior connecting clamps of the sections are used or 200mm if interior connecting clamps of the sections are used. Clearance distance along the service side of the unit must be provided as shown on the Figure 2.

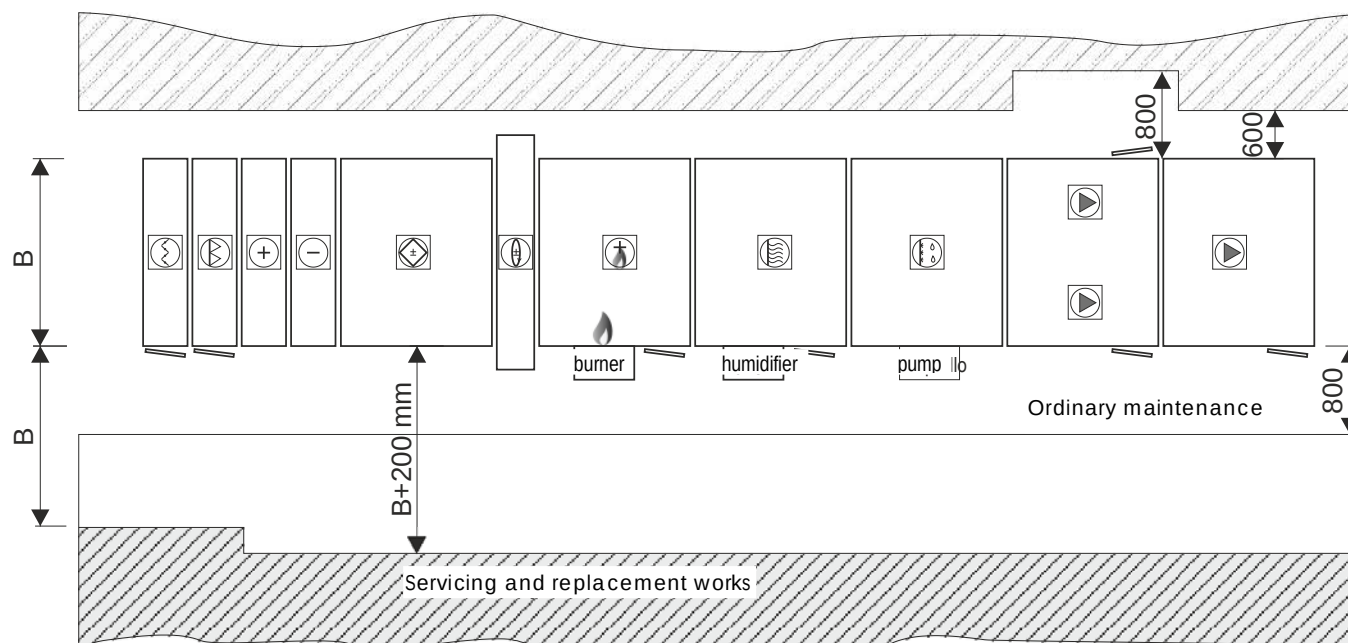


Fig. 2 Minimum clearance distance around the unit

4.5. BASE FRAME, DIMENSIONS OF BASE PLINTH, ANTI-VIBRATION MOUNTINGS



- The plinth on which the unit is to be installed must be structurally adequate to support the operating weight of the unit, level and flat (the maximum permissible difference in elevation between the lowest and the highest point of the base plinth is 5mm). This applies to all sections of the air-handling unit including those installed on the top tier of the unit at tiered units.
- The maximum permissible deflection of the assembled equipment supported by plinth must not exceed 2mm across a 3m distance along the unit's assembly, otherwise the access door may get jammed or air leakage may occur at the section joints. Compensate potential warping of the supporting area by underlying with suitable pads.
- Units must be installed in such a manner as to provide enough elevation for proper installation of condensate traps. In case lower base frame is used on concrete screed in a plantroom installation a depression of adequate depth complying with the efficient height of the trap must be provided in the floor build-up
- The base frame is smaller than footprint of the unit. The base frame is narrower by 5mm on each side in width, by 5mm at each section joint and by 15mm at each end of the unit's assembly.

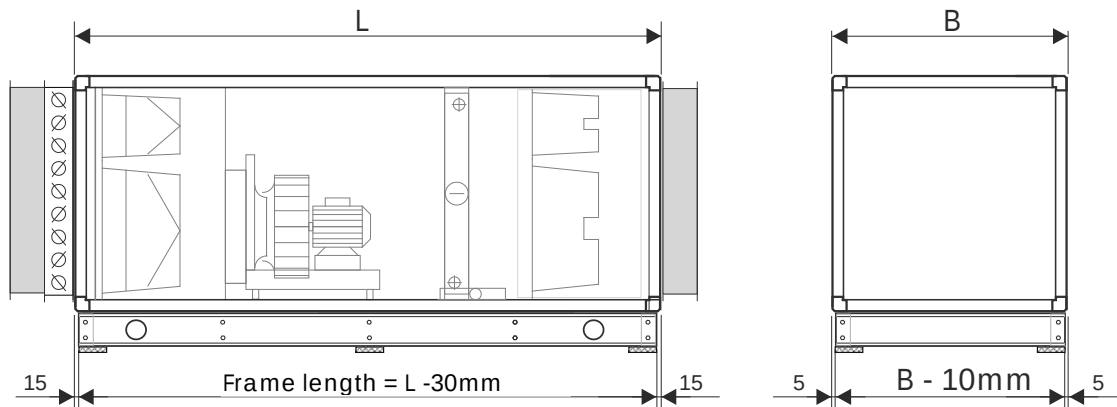


Fig. 3 Offset of the base frame compared to unit's footprint

- The unit must be separated from the supporting plinth by anti-vibration pads consisting of two layers of corrugated rubber 2x5mm (10mm thick in total) or alternatively Sylomer mountings (thickness 20 - 25mm) may be used. The anti-vibration pads and mountings can be ordered as optional accessories along with the unit. Typically the pads are made from a square 150mm x 150mm in size of corrugated rubber. The pads are inserted under the base frame at the ends and at approximately 930mm grid distance in width and length creating regular grid. If the supporting area is not as flat as it should be or the supporting steelwork is deflecting under the unit's weight, the pads have to be thicker to compensate for the deformations or some metal underlays are to be embedded between the corrugated rubber and the floor.

Section length	Width 720-1,650 mm	Width 1,960-2,270mm	Width 2,580-3,200mm
	Number of Sylomer anti-vibration mountings or pairs corrugated rubber squares		
310 - 930mm	4 (2x2)	6 (2x3)	8 (2x4)
1,240 - 2,170mm	6 (3x2)	9 (3x3)	12 (3x4)
2,480 - 2,790mm	8 (4x2)	12 (4x3)	16 (4x4)
3,100 - 3,720mm	10 (5x2)	15 (5x3)	20 (5x4)
4,030 - 5,890mm	12 (6x2)	18 (6x3)	24 (6x4)

Recommended number of Sylomer anti-vibration mountings or pairs of corrugated rubber squares applied under sections depending on section dimensions

Fig. 4 Layout of anti-vibration mountings (example with 4x3 mountings)

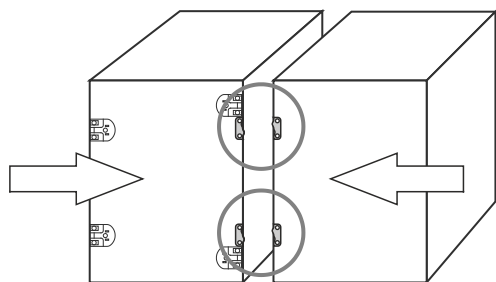
4.6. CONNECTING SECTIONS - GENERAL INFORMATION

- The assembly of air-handling units is to be carried out by the manufacturer's service department personnel or at customer's responsibility by a skilled assembly company following instructions presented in this manual.
- Before assembly, the completeness and good working condition of all parts and sections of the unit have to be checked. Potential defects found must be removed before assembly start. Fan casings must be checked to ensure no foreign objects are present inside the spiral cabinet and in the impeller area. Furthermore, smooth rotation of fan bearings and motor, condition of the anti-vibration mountings, coating paint condition, conductive interconnection of the fan with the unit's framing and V-belt tension all have to be checked.
- Check for correct orientation of the sections as defined with arrow indicating correct airflow direction to ensure erection in the correct sequence.
- Apply self-adhesive gasket EPDM P19 8x4 to one side of the face area of the shipping split being brought together.
- Material for connecting sections together is provided in the unit's delivery.
- The KLMOD units have the base frame installed. Tiered units have the base frame installed only under the bottom tier (top tier is not provided with any intermediate frame). The sections in the bottom and top tier are connected together by threaded bolts (bolts M8x100 with Allen nuts). Holes of 11mm in diameter are pre-drilled in the factory to realize this bolted joint. In special circumstances, when the bolted joint cannot be achieved, joint using eccentric brackets can be used.
- Connections of the supply and return sections of units arranged side-by-side are secured by threaded bolted joint (bolts M8x100 with Allen nuts) or in some cases by eccentric brackets. Check before assembly if the installation area is clear and smooth with no obstacles preventing pulling the supply and return sections together. Remove potential outer clamps or eccentric plates on the sections' contact side and replace them with inner clamps.
- Once the unit comprising multiple sections is assembled, it can be handled only in horizontal direction, however with utmost care and in a very limited extent. The assembled unit **MUST NOT** be lifted, hung or jacked.
- Joints with eccentric brackets are used namely in sections provided with perimeter steel profiles. The eccentric brackets are universal and can be applied both on the inner and outer sides of the sections and for connecting vertical and horizontal walls. If needed, they can be used as additional connection of long horizontal section steel profiles in particular at sizeable units.
- Seal the exterior vertical seams between sections on the outdoor units after completing the assembly. Seal also the horizontal seams between the sections at tiered units to prevent rainwater leakage. UV resistant sealer suitable for outdoor application is recommended (for instance a polyurethane caulk).
- Objects that might obstruct or make difficult the roof assembly on outdoor units must not be fixed or placed on or above the unit (e.g. ductwork or electrical wiring).
- The ventilation ducts connected to the unit must be suspended on dedicated mountings to avoid any stress or weight on the flexible flanges of the unit
- While fitting the actuator's motor direct on the damper it is forbidden to drill into the vertical steel profile – there are gear wheels of the actuator mechanism placed inside the steel profile – the damper could be damaged
- The temperature sensors and required detectors are to be fixed preferably to the steel profiles. Each cut-out or boring in the steel profile must be properly sealed
- Other accessories such as actuators, frequency modulators, pressure gauges and steam generators may be fitted onto the unit's casing. When fitting these accessories onto the unit casing it is important to make sure that the accessories do not interfere in any way with the safe operation and servicing of the unit.
- Nut rivets (M6 or M8) and corresponding metric screws are recommended for fitting of all the accessories to the unit's panels (casing). The load imposed on one rivet nut fitted into the polyurethane insulating panel must not exceed 30 kg; in rock wool insulating panel must not exceed 20 kg. The total load imposed on one panel must not exceed 60 kg. The load imposed on the nut rivets must act only in the vertical direction; load acting in a different direction reduces the load capacity.
- REMOVE SHIPPING BRACKETS if applied in some of the sections for shipment; reinstall the bolts in the nuts. Remove the shipping brackets preferably after the section in question is secured together with the adjacent one. Shipping brackets are used mostly for stability stiffening of some free sections in needed for shipment. Note: the shipping brackets are distinguished by color-coding.



4 METHODS OF CONNECTING SECTIONS

1. EXTERNAL CLAMPS

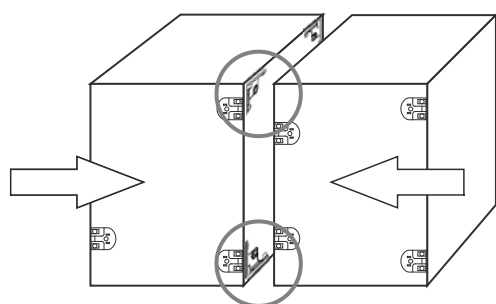


2x exterior clamp, Allen bolt M8x30, thin M8 nut

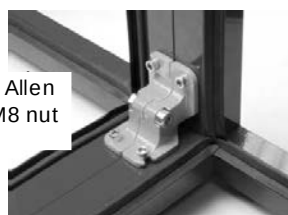


Sections arranged in a row are connected by external clamps. The clamps are factory fitted on the continuous steel profiles of the framing. Bolts and nuts packs are provided.

2. INTERNAL CLAMPS

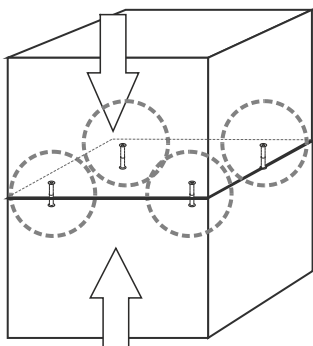


2x interior clamp, Allen bolt M8x30, thin M8 nut



In case the sections are arranged in a row and both of them having access doors, the external steel profile is not wide enough to accommodate the clamps. Therefore internal clamps are to be used in this case. The clamps are factory fitted. This connection method can be applied also if access to the rare side of the unit is not possible.

3. BOLT CONNECTION

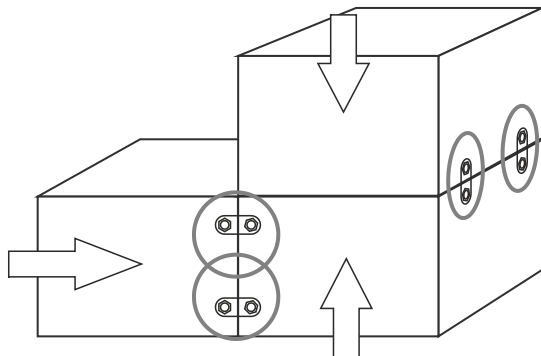


Allen bolt M8x100
Allen nut M8x17
Polyamide washer 10.2
Polyamide washer 8.4

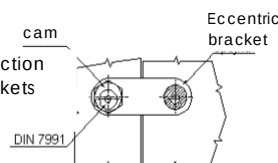


Tiered sections are secured together by bolts, which pull together both levels of sections through an 11mm bore in the bottom panel or steel profile. The holes are factory drilled, bolts' pack is provided.

4. ECCENTRIC BRACKETS



"Goggles" connection
2x eccentric brackets
2x bolt M8x20

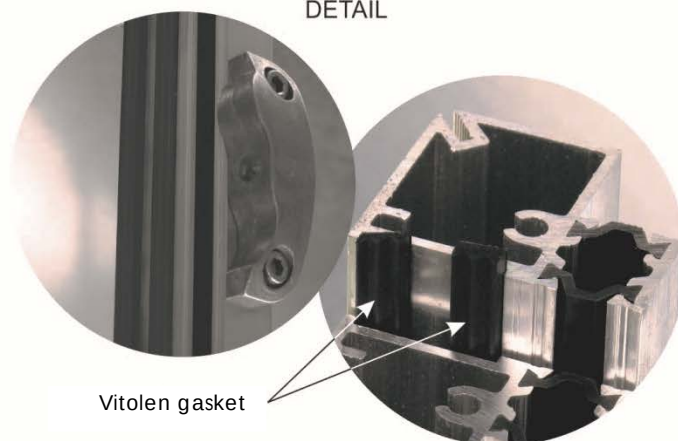


Connection by eccentric brackets is used as an alternative connection method in case none of the connection methods described above is applicable. The eccentric brackets can secure connections of vertical and horizontal steel profile on both the internal and external sides of the sections. The connection is secured with Allen bolts fastened into pre-riveted M8 threaded nuts.

Apply self-adhesive gasket EPDM P19 8x4 to the face area of one of the sections being connected



DETAIL

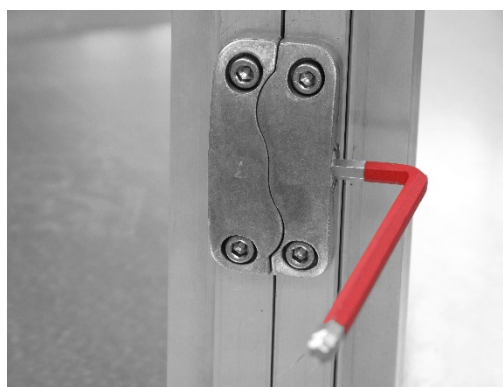


Vitolen gasket

Apply two self-adhesive EPDM P19 8x4 gaskets onto the face area of one of the sections.



Align the sections and guide them as close as possible



Secure the joint with bolt and nut and tight.

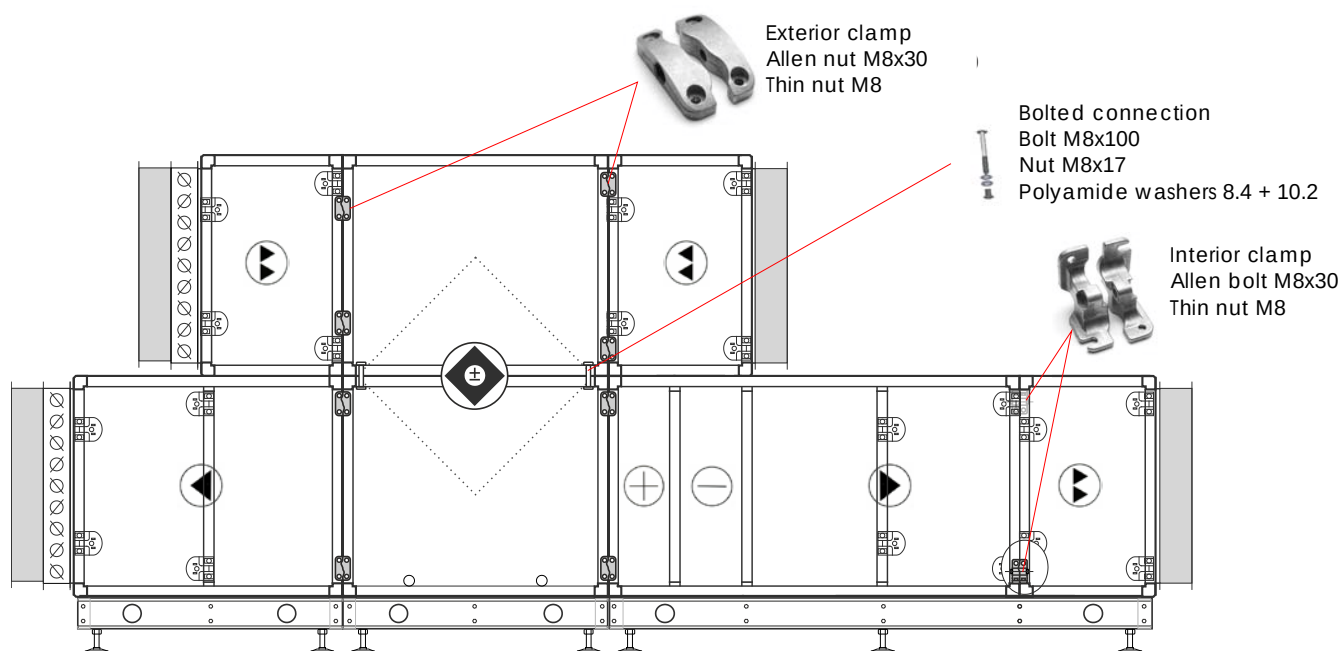


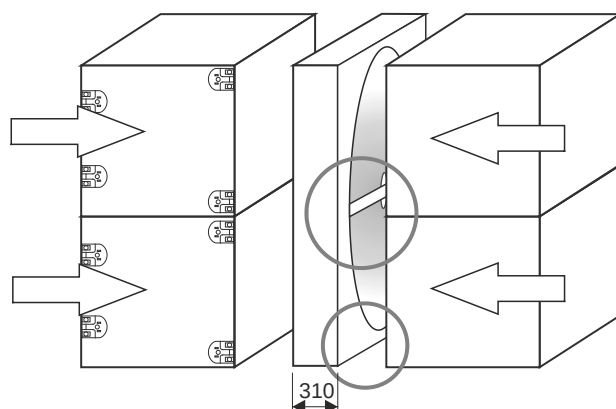
Fig. 8 Example of section connection on KLMOD unit with cross-flow heat recovery device

CONNECTING HEAT RECOVERY WHEEL - ALTERNATIVES

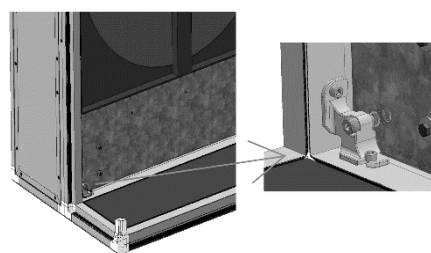
a/ Tiered sections and width of the heat recovery wheel equals the sections' width

a-1) heat recovery wheel section is only 310mm wide

In this case interior clamps are to be used in the section and a nut riveted in the front panel of the wheel serves as mating part. Bolt M8x30 (provided) with internal Allen head is used for the joint.

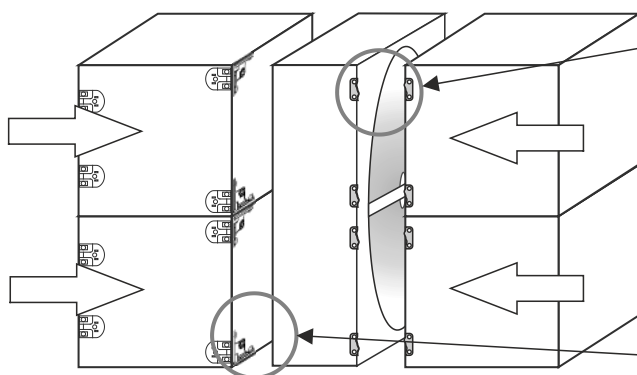


Interior clamp fixed in nut
Allen bolt M8x30



a-2) heat recovery wheel section is 620mm or 930mm wide

In this case standard exterior clamps can be used. If the adjacent door hinges collide (i.e. the wheel section and adjacent section are furnished with access doors) inner clamps are to be used.



2x exterior clamp
Allen bolt M8x30
Thin nut M8

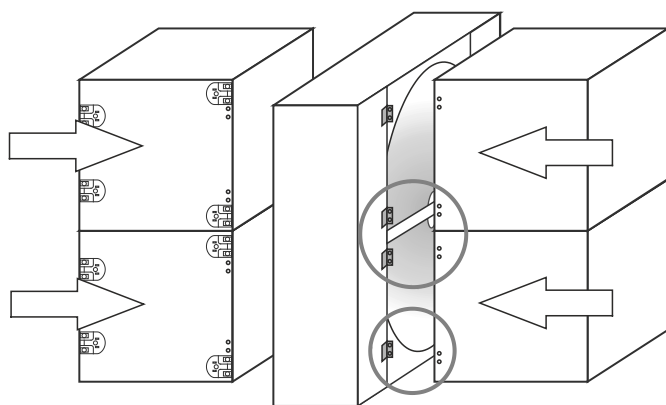


2x interior clamp
Allen bolt M8x30
Thin nut M8



b/ Tiered sections and width of the heat recovery wheel exceeds the sections' width (wheel protrudes):

In this case use special corner clamps with cams. The clamps comprise of angle steel fixed to the wheel section and of two cams with securing bolts, which have to be tightened into threaded nuts fitted in the frame of adjacent section. The sections are secured together by turning the cams.

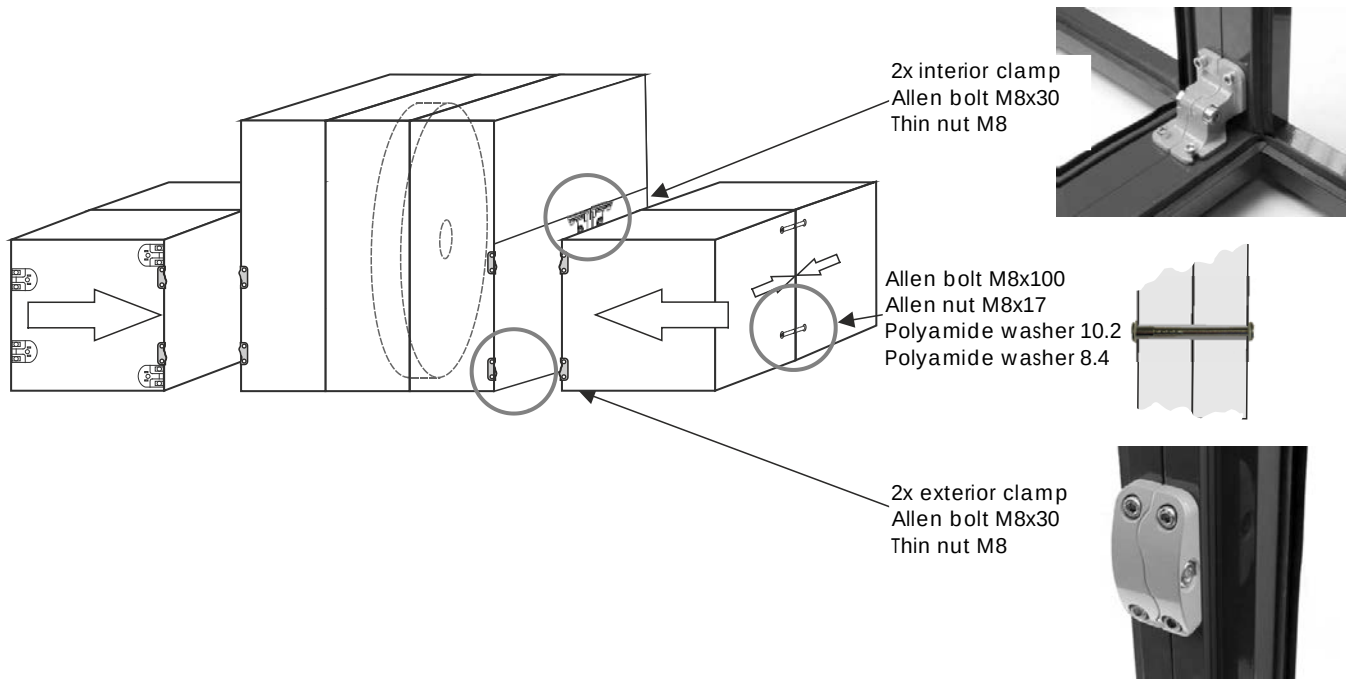


ROV corner connection – eccentric brackets and cams set



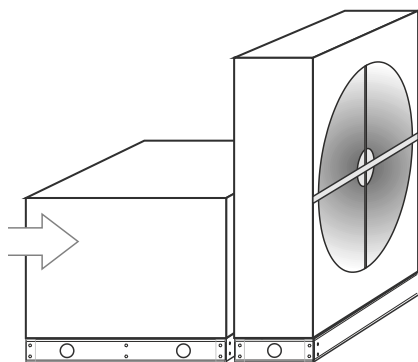
c/ Side-by-side sections and heat recovery wheel is higher than the adjacent sections:

In this case the sections are secured together by bolted joints. Exterior clamps are used to secure exterior sides of the adjacent sections to the wheel section. Internal clamps are used to secure interior sides of the adjacent sections to the wheel section.

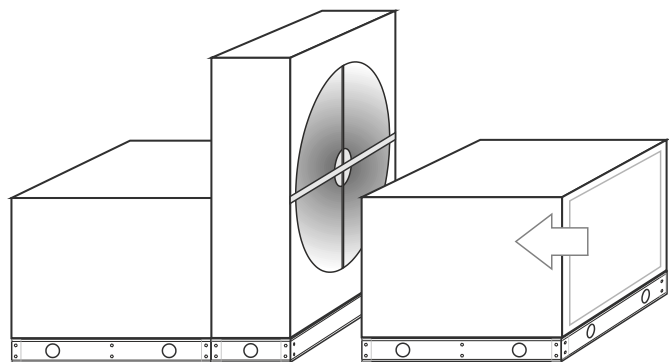


METHOD OF CONNECTING WHEELS IN TIERED AIR-HANDLING UNITS

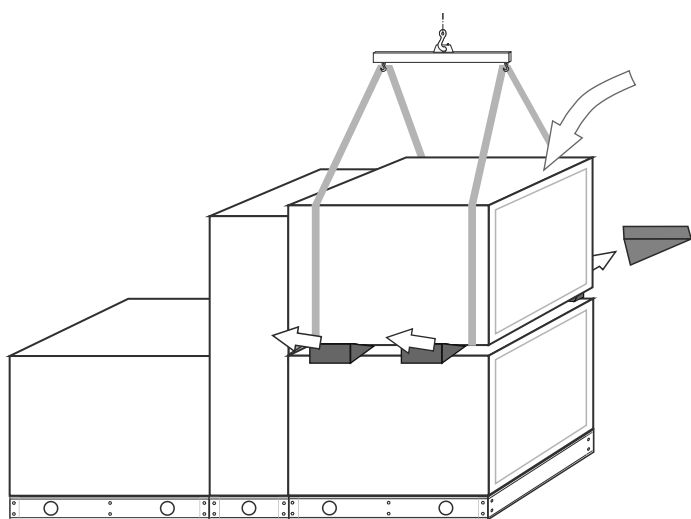
Following guidelines are to be followed when assembling two or three tier units:



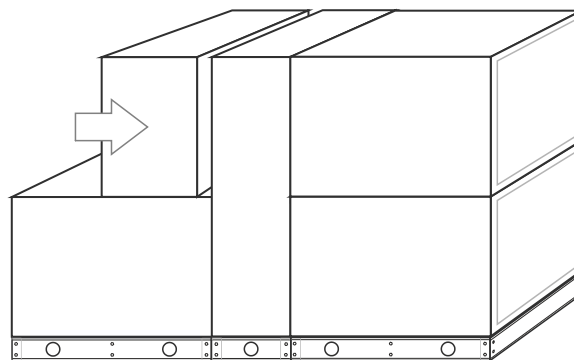
1/ The wheel part projecting into both tiers is to be set in place. Bring the adjacent section together and connect with the wheel part by tightening the clamps' bolts.



2/ Bring and secure together all the remaining sections of the bottom tier. Make sure the base of sections is aligned and the level. Use pads if the floor is not as flat as it should be level the base frame.



3/ Set the top tier sections in place. Forklift or crane may be used for rigging (using slings). Wooden wedges may be used to facilitate guiding the sections together.



4/ Complete the installation by installing the remaining sections of the top tier. Heating pipe lines, electrical cabling etc. can be connected to the unit only after the sections have been thoroughly bolted together.

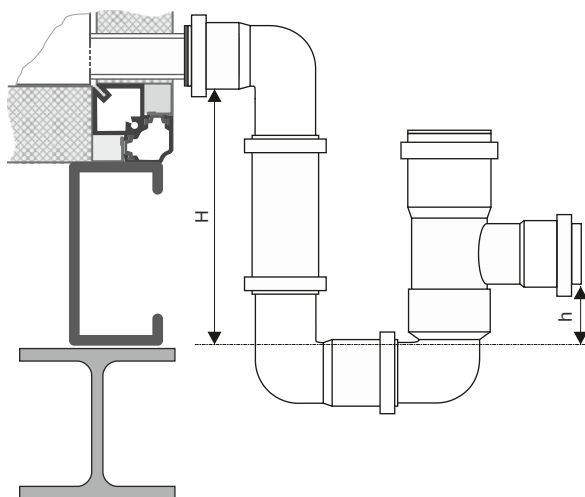
4.7. TRAP INSTALLATION

- All condensate drain lines connected to the building drainage system (to be introduced for cooling section, cross-flow heat recovery, air-washer and steam humidification sections) must be connected to the building drainage system through traps in order to realize correct operating of these sections.
- Every section is furnished with its own trap, which is part of the delivery as a standard. The standard traps are suitable for pressures ranging from -1,300 Pa to +1,400 Pa. If a different pressure range is anticipated the trap height has to be adjusted accordingly. Please consult the correct trap height needed in such case with the manufacturer.
- The trap can be vertically adjusted by sliding the moveable segments up and down. If the structure supporting the unit allows sufficient elevation and there is enough space under the unit, stretch the trap's segments as much as possible while keeping a minimum 10mm overlap of the movable segment over of the sealing gasket level.

Fig. 9 Example of trap installation methods depending on pressure condition inside individual sections of the unit

NEGATIVE PRESSURE TRAP (installed upstream of the fan)

- Sections located in the unit downstream of the fan are subject to negative pressure compared to the atmosphere. Negative pressure rate at the trap equals the negative pressure rate at the fan suction less pressure drops of the unit's components placed between fan and the respective section with trap.
- The negative pressure trap JANKA includes a ball acting as back-flow valve ensuring proper function of the trap in situation it is not filled with water and preventing smells from the drainage line to leak into the unit.
- Trap connection to the connecting nipple on the unit must be done through gas-tight rubber sleeve.
- The trap can be set up for up to 1,300Pa negative pressure (maximum pull-out H to 160mm and minimum pull-out h to 30mm). If the 120mm high base frame is used and the unit stands of the floor without any plinth, the trap cannot be stretched to the maximum height, but only as much as it hits the floor. The elevation of the connecting nipples on the condensate pan is above the floor is 190mm. The dimension H can be stretched to 120mm as a maximum, the dimension h is 30mm. The pressure built by the trap is only 900Pa in this case. For further increase of the pressure by approximately 300Pa the vertical part with the back-flow valve (ball) can be tilted to the left or to the right – to such an extent that the trap angle to horizontal level is 15° maximum. The first segment of the trap at the unit nipple connection remains vertical.



There must be sufficient difference in water elevation between the input and output sides of the trap. This gives a head of water which creates underpressure needed to accomplish the condensate water draining off the pan.

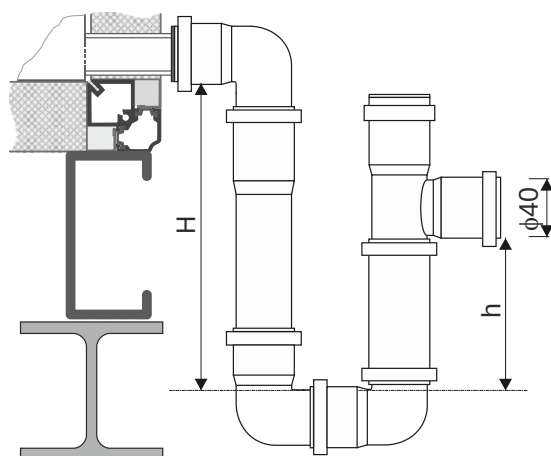
$$\Delta p = (H - h) \times 10$$

$$\text{Example: } 1,300\text{Pa} = (160\text{mm} - 30\text{mm}) \times 10$$

Example of trap installation for units with 120mm high base frame. In this case the water head achieved by the trap is $H - h = 120 - 30 \text{ mm} = 90 \text{ mm}$ i.e. $\Delta p = 900 \text{ Pa}$. This trap is appropriate for installation with maximum negative pressure of 900Pa.

POSITIVE PRESSURE TRAP (installed downstream of the fan)

- Positive pressure trap is installed in sections positioned downstream of the fan in the unit's assembly. These sections are therefore subject of positive pressure compared to the atmosphere outside of the unit. Pressure at the trap equals the pressure at the fan discharge less pressure losses of the parts found between the fan and the section where the trap is installed.
- Positive pressure trap prevents smells in the drainage line from penetrating into the air-handling unit. Water head present in the trap must be in excess of the pressure inside the unit, otherwise the water in the trap is forced in the drainage line.
- When the unit is operated, the traps installed at the positive pressure sections must be filled with water. During the shutoff period the trap does not be filled with water providing the connecting sockets for the traps are capped off.
- It is possible to visually check whether the positive pressure trap is adequate for the given unit. During the unit start-up and operation (with no condensation occurring), water from the trap must not be forced into the drainage line.
- The trap can be set for operating pressure of up to 1,400Pa as standard (stretch $H = 230 \text{ mm}$ and maximum stretch $h = 140 \text{ mm}$).



Positive pressure trap prevents smells in the drainage line from penetrating into the air-handling unit. The water column "h" must not be forced by the pressure inside the unit into the condensate drainage line.

$$\Delta p = h \times 10 \text{ and at the same time } H > h$$

Example: $h = 140 \text{ mm}$

$$\Delta p = 140 \times 10$$

$$\Delta p = 1.400 \text{ Pa}$$

- If the 120mm high base frame is used and the unit stands on the floor without any plinth, the trap cannot be installed in vertical position due to its length. In this case the trap can be turned around the connecting nipple so it is tilted. In this way the siphon height decreases. It is necessary to make sure the minimum operating height h of the trap is not underrun.

Example of trap installation for units with 120mm high base frame. In this case the water head achieved by the trap is 100mm. $\Delta p = h [100mm] \times 10 = 1000Pa$. This trap is appropriate for installation with maximum positive pressure of 1,000Pa.

INSTALLATION

- Each section with drain pan must be trapped separately. The traps are part of the sections' delivery as standard.
- The condensate drain line positioned downstream of a self-standing trap must be terminated in the atmosphere after a maximum distance of 1m, i.e. the condensate drain line must not connect direct into a building drainage line.
- Condensate drain lines can be combined downstream of the traps routed as a common drain line. The common drain line must be terminated in the atmosphere after a maximum distance of 1m downstream of the last trap. The negative pressure trap JANKA includes a ball acting as back-flow valve. Positive pressure traps must be filled with water.
- The trap must always be set on drain nipple at the unit. Never connect drain nipples with a combined drain line from multiple sections leading afterwards to one common trap.
- During the winter season the condensate drain line including the traps must be heated by heat trace to prevent freeze.
- To ensure proper condensate drainage the unit must be level to achieve good drainage through the drain nipple and to avoid condensation water built-up at the opposite side of the condensate pan.
- After installation, fasten the trap in order to prevent inadvertent disconnection of the trap due to the weight of water accumulated inside the trap.
- Standard axis-to-axis elevation of the condensate drainage is 190 mm at units with 120mm base frame. In-field structural modification related to a different trap elevation is to be resolved by the designer.
- Elevation of the unit above the floor may be increased by installation of base frame furnished with adjustable revolving legs
- Connecting drain nipple furnished on the condensate pan has diameter $\varnothing 30mm$.

OPERATION

- The operator is obliged to check the traps at least twice a year for tightness and clogging. In addition arrange for checks of proper drain nipple connection and tightness of the sealing ball at the negative pressure traps.

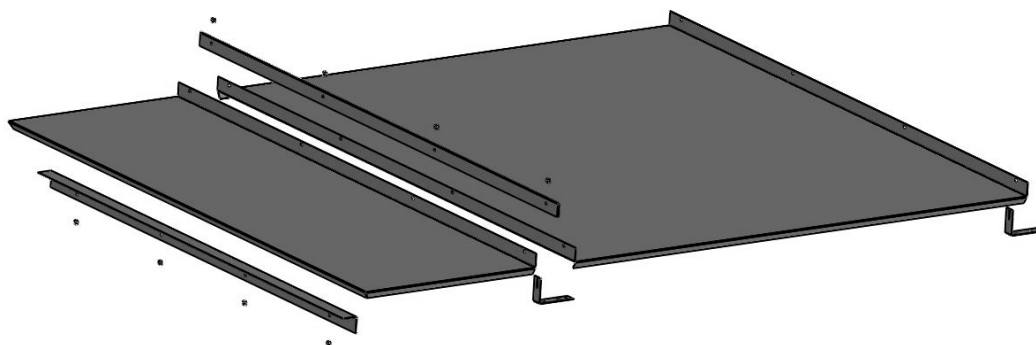
4.8. ROOF COVER INSTALLATION

ROOF COVER DESCRIPTION

The outdoor models of KLMOD air-handling units are provided with prefabricated metal sheet roof cover. The roof cover consists of multiple parts (running roof segments), which cover the whole width of the units. The running roof segments have drip molding arranged lengthwise and perpendicular upstands for connecting the adjacent running roof segments together. Fixing brackets fixed with rivets to the unit's top panels are placed at the front and rear ends of each running roof segment, holding the roof segments to the unit. The running roof segments are mutually seamed; the seams are capped by U shape strips and riveted. Starting roof segments positioned at the front ends of the unit are furnished with the drip molding also on the front side. The starting roof segments are, in addition to the running roof segments, fixed to the unit's top panels with a continuous U shape trim over the whole width of the unit, which prevents lifting the roof by strong winds.

The sections delivered (shipping split) have the roof cover fully installed. Sections to be connected to another section in field have got the roof cover segments prepared for easy connection with the roof cover segments on the adjacent sections.

End part „U“ shape strip Running roof part



ROOF ASSEMBLY IN FIELD

Roof covers of the KLMOD units are factory installed on the shipping splits and are ready for mutual connection. Once the unit is in position and assembled the roof cover is to be completed.

Tools required:

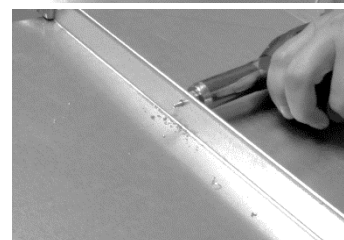
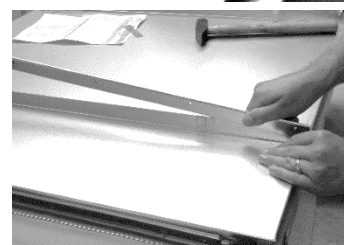
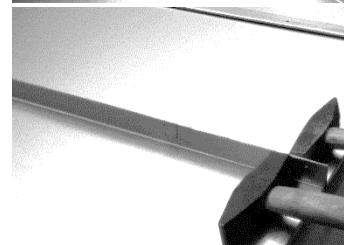
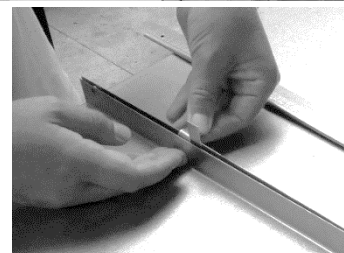
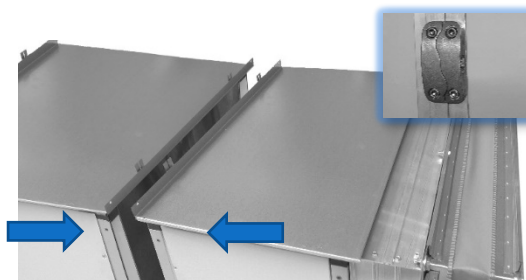
- Accu drill, borer diameter 4,2
- Riveting nippers
- Cherry rivets 4x6
- 2x hammer



ROOF CONNECTION

1. Secure the sections firmly together (see paragraph Connection Sections). Apply two self-adhesive Vitolen gaskets onto the face area of one of the sections, pull sections together as much as possible and secure together by clamps delivered.
2. Both edges of the roof segment are provided with upstands and protruding fixing brackets. Fixing brackets are holding the roof segments onto the unit's top panels. Fold down the protruding fixing brackets ALWAYS OVER THE UPSTAND ON THE ADJACENT ROOF SEGMENT in order to pull the roof segments firmly together as much as possible. Work in the same way on all the fixing brackets.
3. Press down the folded brackets to allow easy slipping of the U shape strip on the seam. Use two hammers hitting against each other for pressing the folded brackets.
4. Set the U shape strip on the seam of the roof segments to achieve final capping of the seam.
5. The U shape strip fully set on the seam is to be squeezed along its length by hitting with the flat side of hammer. Proceed with care in order not to rip open the top edge of the U shape cap.
6. Drill holes through the seam; follow the pre-drilled holes patter in the U shape strip. Use borer diameter 4.2mm.
7. Compress firmly the seam by rivets using aluminum cherry rivets 4 x 6mm and riveting nippers.

Finally clean thoroughly the roof from debris left after the work (steel chips etc.)



5. SECTIONS STARTUP

5.1. DAMPERS

The dampers' section is intended to control airflow, to ensure mixing supply and return air and to close off the unit by means of regulating dampers. The dampers consist of an aluminium frame and aluminium shaped blades furnished with rubber seals fitted on the seating edges. The plastic gear is concealed inside the side panel aluminium steel profile being protected from becoming soiled by impurities carried by the air drawn. The dampers are motorized driven by actuators or operated manually

INSTALLATION

- Before assembly and start-up of the unit the flexible flanges have to be installed on the bottom side of the section - down suction or down exhaust. The flexible flanges are loose placed inside the unit during shipment in order to be protected from damage
- Motorized dampers driven by actuators come with a free end of the drive shaft (cross-section of 12 x 12 mm) onto which the actuator is set.
- The correct blade orientation is marked on the damper shaft with a punch mark. The punch mark and the blade are to be parallel.
- Use a rod and joints for the potential coupling of two dampers.
- Before start-up of the damper testing of no-load operating of the actuating mechanism is recommended including setting the end-stop damper positions. In this way potential damage to the actuating mechanism is prevented.
- It is forbidden to drill into the side wall steel profile – there are gear wheels of the actuator mechanism concealed inside the steel profile and could be damaged.



OPERATION

- Dampers' operation can be controlled by modulated mechanism (by actuators) or they can be installed fixed in a pre-set position (by actuator or by a hand lever with a position locking)
- The dampers' operation is very reliable; potential faults may be caused by excessive dust or if the recommended maximum damper's surface temperature of 40°C is exceeded, which would lead to damage of the plastic gear of the blades
- Check on regular basis the ends top positions of actuators.

HEATING OF DAMPERS

Heating of dampers provides freeze protection of dampers positioned on the fresh air intake side in case the unit is installed in an extremely cold environment.

- Resistance heat trace with 12 - 25W/m output rating can be used for damper's heating. The heating trace is made from two-core braided cable, insulated and comes with an extension lead for power supply connection (length 1m, 1.5m or 2m according to the output rating). Supply voltage for all heat traces is 230V/50Hz.
- Depending on the damper's size the heat traces' length varies from 3 to 180m and the output rating varies from 35W to 3.5kW.
- Switch-on of the heat trace proceeds through a thermostat when ambient temperature drops down to $+5^{\circ}\text{C} \pm 3\text{K}$.
- Heat trace cable must not be cut in length; its parts must not be in touch at overlapping loops or crossings.
- Do not use heat trace in areas with ambient temperature exceeding 80°C.
- Protect the heat trace from mechanical damage.

Electrical wiring connection: brown - phase, blue – neutral, yellow-green - protection ground

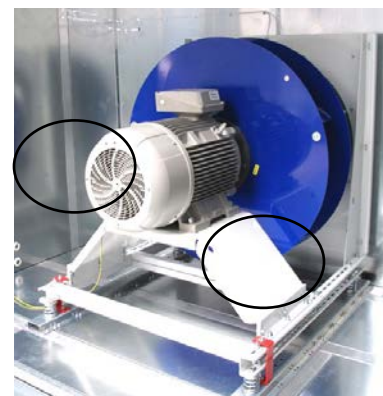
5.2. FAN WITH FREE IMPELLER (PLUG-FAN)

Fan section is designed to draw the air and air-like mixtures. The fan section is the most important assembly part of the air-handling unit. At the same time it is very susceptible and maintenance demanding. Medium-pressure free impellers are implemented in this section are set directly on the motor's shaft. As the free impeller's revolving speed always equals to the revolving speed of the asynchronous motor, fine setting of the working point must be accomplished by frequency modulator modulating the motor's speed.

INSTALLATION



- **The red-coloured shipping brackets at the fan's seating** protecting the fan's assembly, motor and flexible mountings of the fan from damage during shipping **must be removed before the unit is put into operation**
- Sections with down suction or down exhaust have flexible flanges for duct connection shipped free inside the section in some cases. This is to protect the flanges from damage during shipment. Before assembly and startup of the section the flexible flanges are to be installed on respective side of the section as shown on the schematic diagram.
- Installation works and in-field electrical wiring must be carried out by authorized professional company.
- Finally clean thoroughly any debris left after the work and make sure there are no foreign objects left in vicinity of the impeller and suction area.
- Keep the ducting nearby the fan free and clear to ensure no objects are flying off the fan area as being drawn by the air flow.
- The fans may start up only after the unit is ducted to building's ventilation system. All sections of the unit must be set and access doors on all panels must be closed. Measure the current drawn by the motor at the start up procedure.
- After one hour of unit's operation check that the torque moment on the bolts holding the impeller to motor's shaft (Taperlock) comply with the torque moment values required as specified in the Table 4, chapter Installation of Taper®-Lock pulleys.
- Remove the polyethylene information pocket with technical documentation provided on the inside a section access door to prevent the pocket from being sucked into the impeller causing subsequent damage.



REMOVE SHIPPING
BRACKETS!



OPERATION

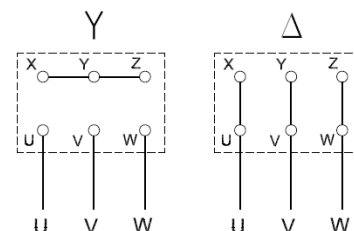


- Make sure the fan does not suck-in any objects or sticky dust (for instance during startup running when no filters are in position yet or if used for temporary ventilation of unfinished building). The impeller has been statically and dynamically balanced in factory.
- **DO NOT OPEN ACCESS DOOR WHEN THE FAN IS RUNNING!**
- There is permanently positive pressure inside the plug fan section in normal operating condition (the fan is sucking the air through diffuser and is pushing it forward into the motor section). Therefore, when attempting to open the access door on the fan's section with the fan running, a force is pushing the door open. A significant force caused by the pressure inside the section tends to open the door violently at bigger units, which might lead to personell injury. The fan's section access door must be provided with at least one lock to be open only by a special tool preventing any unauthorized person from tampering with the access door.
- After the fan stops running or during an electricity blackout the supply of system fluid into the heaters must be reduced so that the ambient temperature at the fan and motor does not exceed +40°C.

5.2.1. MOTOR'S ELECTRICAL CONNECTION THROUGH FREQUENCY MODULATOR



- All in-field electrical wiring must be provided by licensed installer.
- Motor wiring diagram can be found on the inside of the lid on the terminal box on each motor. Small motors with output rating up to 3kW are typically wired in star (230/400V Δ/Y), big motors from 4kW onwards are typically wired in triangle (400/690V Δ/Y).



- Suitable shielded cable is to be always used for wiring of motors equipped with frequency modulators, for instance Lappkapel Ölf ex 100-CY, Helu Y-CY-JB or Helu Topfl ex-EMV-UV-2YSLCYK-J
- Connecting cables leading from the frequency modulator to the terminals inside fan section have to be fed through grommets. The grommets for feeding cables are located on the service side of the unit. Cap off unused grommets.
- Thermal protection devices of the motor (thermistor or thermo-contact have to be connected to relevant terminals on the frequency modulator. Thermal protection contact can be found in the terminal board on the motor.



- Due to safety reasons a service switch is recommended to be installed near the fan section. The service switch allows the servicing personnel to isolate the electricity supply to the motor in fan section. The service switch is a three-phase switch isolating electricity supply to frequency modulator. With frequency modulators Danfoss, the service switch can be alternatively installed on the connecting cable between the frequency modulator and motor as the Danfoss frequency modulators are adjusted to allow for interruption of electricity supply on their output side (on the side of frequency modulated signal).



- Feeding of frequency modulators is achieved by ordinary power cables. Observe instructions outlined in the user's manual of frequency modulator.
- Protection fuses of the frequency modulator are to be designed for the maximum intermittent current input enhanced by approximately 10%. The circuit breaker with nearest higher amps rate with "B" tripping characteristic is to be used.
- Provide measuring of isolating resistance of the motor before its first startup to prevent potential damage. Proceed in compliance with the code ČSN350010, par. 8.
- Positioning of frequency modulator must be in compliance with its IP protection rating. Frequency modulators with IP protection rating IP20 and IP21 are intended for installation inside electrical panels or in areas compatible with this IP rating. Frequency modulators with IP54 and IP55 can be installed in normally accessible areas. Suitability of the place of installation of frequency modulators has to be assessed by the designer of electrical installations.



- **Always set correct operating frequency of the motor at fans with free impeller** in the frequency modulator menu. Also the maximum permissible frequency must be set to prevent the free impeller from overrunning into critical revolution speed.
- Check the current drawn at the motor's startup. If the current drawn is higher than indicated on the performance plate on the motor, the fan must be switched off and the cause of excessive current drawn must be identified.



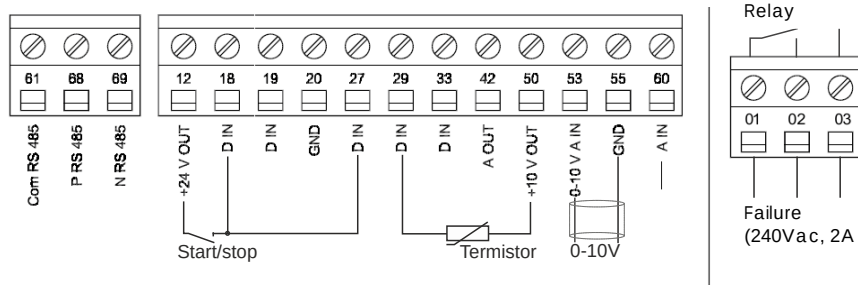
- **Check direction of free impeller rotation;** use the guiding arrow provided on the free impeller showing the correction rotation direction. In case of the free impeller is rotating in wrong direction, the phases on electrical cable between frequency modulator and motor must be changed (changing of phases on the feeding cable to the frequency modulator has no influence on the rotation direction).
- Avoid frequent starting and stopping of fan's operation to prevent its premature wear and tear.

RECOMMENDED WIRING AND SET UP OF DANFOSS FREQUENCY MODULATORS

Observe installation instructions outlined in the user's manual shipped along with the frequency modulators.

Frequency modulators Danfoss FC 51 and FC 101 – terminals wiring:

- 53 towards 55 control signal 0 to10V
- 12 towards 18 remote start/stop
- 50 towards 29 motor thermistor
- 01 - 02 - 03 normal operation / failure signal to BMS



Recommended set up of frequency modulators FC 51 and FC 101 for plug-fan drives

- 1-20 motor's rated output – according to motor's plate
- 1-22 motor's voltage - according to motor's plate
- 1-23 50Hz – nominal motor's frequency - according to motor's plate
- 1-24 motor's current drawn - according to motor's plate
- 1-25 nominal speed of motor – as per motor's plate
- 3-02 20Hz – minimum frequency
- 3-03 54Hz – Operating frequency specified
- 3-15 analogue 53 - (control input 0-10V)
- 3-16 0 – no function allocated
- 3-41 10s-60s acceleration time
- 3-42 10s-60s deceleration
- 4-10 0 clockwise – direction of rotation
- 4-12 20
- 4-14 59Hz - Max. frequency for the application given as outlined in performance specification
- 4-19 59Hz - Max. allowed frequency (not at type FC51)
- 6-10 0V
- 6-11 10V
- 6-14 20Hz (frequency at 0V)
- 6-15 54Hz – Operating frequency at 10V – as outlined in performance specification
- 1-90 2 - (thermistor overheating switching off frequency modulator)
- 1-93 6 – thermistor in on input 29
- 1-62 0 – slip compensation
- 1-73 1 – permit flying start
- 5-12 0 - no function allocated
- 5-13 0 - no function allocated
- 5-40 6 - RUN (relay 1 switches if frequency modulator runs),
or alternatively 9 - ALARM (relay 1 switches on a failure, setting for JESY BMS)

(3) Přívodní ventilátor			s	obslužný panel (Pravé)	
Údaje o ventilátoru				Údaje o motoru	
Velikost	D 560 P	Std.		Výkon	4 @
Lopatky	Plug Fan				OP 3,41 kW
Izolátory	Pryž			Napětí	400/690V-3ph-50Hz
Otáčky	1571	ot/min		Krytí	IP55 Termistory
Účinnost	79	%			(A44)
Příkon	3,09	kW		Prov./Max. Frekv.	54/59 Hz
				Otáčky nom./max.	1455/1710 ot/min
				Jmenovitý proud	8,2 @
					OP 7,3 A
				Kód motoru	112.4.B3.4kW.S.S
					(340199)

Parameter's reading:

- 16-61 shows settings of input 53 (voltage/current)
- 16-62 shows parameter value on input 53
- 14-22 parameters' reset to factory settings – initiating

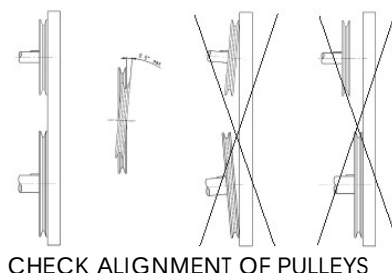
5.3. V-BELT DRIVE FANS

Air or air-like mixtures are drawn through the fan section. Both-side suction low pressure or medium pressure fans with V-belt drives are used in this section. The fan section is the most important assembly part of the air-handling unit. However, it is very sensitive to incorrect handling and very maintenance demanding.

INSTALLATION



- **The red-coloured shipping brackets at the fan's seating** protecting the fan's machinery, motor and flexible mountings of the fan from damage during shipping **must be removed before the unit is put into operation.**
- Sections with down suction or down exhaust have flexible flanges for duct connection shipped free inside the section in some cases. This is to protect the flanges from damage during shipment. Before assembly and startup of the section the flexible flanges are to be installed on respective side of the section as per the schematic diagram.
- Installation works and in-field electrical wiring must be carried out by authorized professional company.
- Check alignment of the pulleys. Check alignment of pulleys face sides at one plane with a ruler or laser ruler GATES.



- Check tension of the V-belts; adjust to correct value if needed. The V-belt tension is to be checked in compliance with the code ČSN 02 3109 and following the information provided in the transmission data sheet of the transmission given. The transmission data sheet is shipped together with the installation and operating guidelines in a pocket attached to the inside of fan section access door.
- The V-belt tension values presented in the transmission data must be necessarily adhered to.
- Clean thoroughly any debris left after the installation work and make sure there are no foreign objects left in vicinity of the impeller and suction area.
- Keep the ducting nearby the fan free and clean to ensure no objects fly off the fan area being drawn by the air flow.



- The fans may start up only after the unit is ducted to building's ventilation system. All sections of the unit must be set and access doors on all panels must be closed. Measure the current drawn by the motor at the start up.
- Remove the polyethylene information pocket with technical documentation provided on the inside a section access door to prevent the pocket from being sucked into the fan causing subsequent damage.
- The installer must check V-belt tension after the first 24 hours of unit's operation and adjust the tension to comply with the values required in the transmission data sheet.

OPERATION

- When replacing the V-belts use SOLELY the V-belt listed in the transmission sheet provided with the unit. The type, length and manufacturer of V-belts as specified in the transmission sheet must be adhered to. If the V-belt specified is not available, request it at Janka Engineering commercial representative or service department. Use of a different V-belt type will void the warranty of fan's correct operating.
- Make sure the fan does not suck-in any objects or sticky dust (for instance during startup running when no filters are in position yet or if used for temporary ventilation of unfinished building). The impeller has been statically and dynamically balanced in factory.
- In case the fan's speed is not controlled by frequency modulator or a SOFT START device, it is useful to shut-off the dampers at each start of the unit to facilitate motor's run-up. The dampers open gradually again after the unit starts.
- After the fan stops running or during an electricity blackout the supply of system fluid into the heaters must be reduced so that the ambient temperature at the fan and motor does not exceed +40°C.
- DO NOT OPEN ACCESS DOOR WHEN THE FAN IS RUNNING!
- There is permanently negative pressure inside the radial fan section with V-belt drive in normal operating condition (the fan is sucking the air from the fan's section area and is pushing it forward).



through spiral case into the adjacent section). Therefore when attempting to open the access door on the fan's section when fan is running, the negative pressure hinders the access door from easy opening. The fan's section access door must be provided with at least one lock openable only with a special tool preventing unauthorized person from accessing the fan's section.

- Particular attention must be given to the bearing. Temperature of the bearings must not exceed $+80^{\circ}\text{C}$. If this temperature is achieved, the fan must be stopped and can be started again only when the bearings cool down. The cause of increased temperature may lay in over-lubricated or insufficiently lubricated bearing, deficient lubricant, defective bearing or incorrectly tensioned V-belts (loose or overly tensioned).
- Check alignment of the pulleys. Check alignment of pulleys' faces at one plane with a ruler or laser ruler GATES.

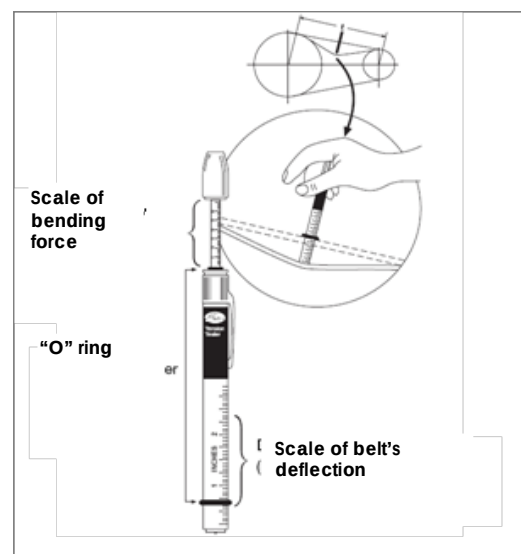


MEASUREMENT OF V-BELT TENSION

Measurement of the V-belts' tension can proceed either manually using a Tension tester or using Sonic Tension Meter. In any case, do not just estimate the tension of V-belts "by experience". It positively leads to an insufficient tension of the V-belts and their subsequent destruction. The required tension values for measurements are given in the transmission data sheet, which is furnished as part of the technical documentation for each fan section.

Manual measurement using Tension Tester (pen-type)

- Set the deflection of the belt on the bottom scale by using the ring. The deflection value required can be found in the transmission data sheet (an example is shown in Appendix 9.1).
- Keep the upper ring on the zero value.
- Put a straight ruler across the pulleys.
- Place the Tension Tester perpendicularly to the centre of the V-belt and apply adequate pressure on the tester until the lower edge of the lower ring is aligned with the axis of the ruler's plane.
- Use the upper ring to read the deflection force F [N].
- Compare the measured force with the values of "Deflecting force referred to groove" shown in the transmission data sheet.
- If the measured force F is less than "The minimum deflecting force referred to groove (N)", the V-belt must be tensioned.
- If the measured force F exceeds "The maximum deflecting force referred to groove (N)", the V-belt's tension must be relaxed.
- Observe the values of the tensioning forces presented in the transmission data sheet for tensioning or relaxing the V-belt – measurement taken after 24 hours operation.
- If the transmission data sheet is not available, an approximate method can be used for measuring of the belt tension (only suitable for short-term operation of the unit, such as unit's start-up).
- Set the value " f " = 1.5 mm for every 100 mm of the pulleys' axis distance by the ring at the bottom of the scale. Compare the values of the required deflection in the middle of the V-belt with the values shown in the table "Indicative values for temporary tightening of V-belts", see Appendix 9.1.1 .



Measurement using Sonic Tension Meter

- The required values for measurements are given in the transmission data sheet, which is furnished as part of the technical documentation for each fan section. An example is shown in Appendix 9.1.
- Enter the values of specific mass of the belt (MASS), width of the belt (WIDTH) and length of the belt's span (SPAN).
- Hold the sensor about 10 cm away of the belt and hit slightly the belt with your finger.
- Compare the measured value f (frequency [Hz]) with the values of min/max frequency shown in the transmission data sheet, an example is shown in Appendix 9.1.
- If the measured f is less than the "Minimum frequency (Hz)", it is necessary to tighten the belt.

- If the measured f is higher than the "Maximum frequency (Hz)", it is necessary to relax the belt.
- Observe the values of the tensioning forces presented in the transmission data sheet for tensioning or relaxing the V-belt – measurement taken after 24 hours operation.

Problems resulting from insufficiently tensioned V-belt

- Excessive abrasion of the V-belt as a result of the V-belt's bouncing in the pulleys' groove.
- Excessive operating noise.
- Excessive belt's vibrations.
- Insufficient force transmission.

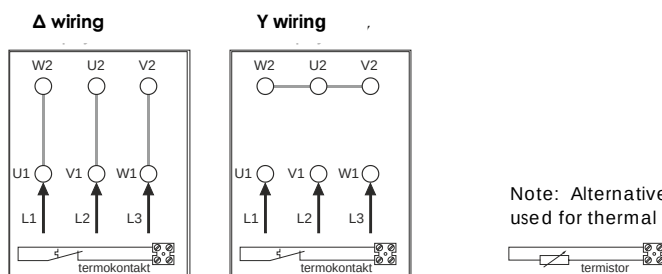
Problems resulting from over-tensioned V-belt

- Excessive loading on bearings, shaft and motor leading to reduced service life of these components.
- Increased loading on all the other components.
- Increased vibrations and noise.

5.3.1. DIRECT WIRING OF MOTORS TO POWER SUPPLY LINE – with the exclusion of frequency modulator



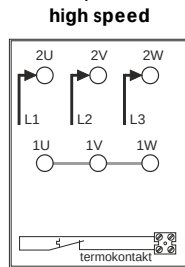
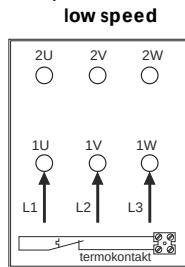
- Motor wiring diagram can be found on the inside of the lid on the terminal box on each motor.
- Rated output of the motors has to be adjusted in compliance with the code ČSN 35 0000-1, par. 3.6. if motors are used in an environment with adjacent temperature exceeding +40°C or at altitude above 1000m above sea level.
- The thermal protection contact on the motor's terminal box must be wired as well at motors provided with thermal protection.
- The motors must be protected against overloading and short-circuit. To protect the motors from overheating due to overvoltage surge, an overvoltage relay and thermal protection must be provided on the motor.
- Implementation of overvoltage protection device before the motor is mandatory in all cases, i.e. also when internal thermal protection is used.
- The electrical feeding cables to the terminal boxes of motors in fan sections are to be made of flexible type cable pulled through grommets. Unused grommets have to be capped off.
- The grommets for feeding cables are located on the service side of the unit.
- Provide a test measuring of isolation resistance of the motor before its first startup to prevent potential damage. Proceed in compliance with the code ČSN 35 0010, par. 8.
- The motors with rated output up to 3kW with three-phase supply voltage 3x400V are wired in star (triangle wiring is used for 3x230V voltage). These motors are starting directly.
- Motors with rated output of 4kW and higher are wired in triangle for supply voltage of 3x400V (star wiring is used for supply voltage 3x 690V). Motors with rated output above 4kW are recommended to be equipped with Y - Δ switching-over, otherwise the V-belts are subject of excessive wear and tear.
- A SOFT START device ensuring smooth run-up is recommended for motors with rated output exceeding 30 kW.



Wiring of single-speed motors for star / triangle run-up (for motor with rated output from 4kW)

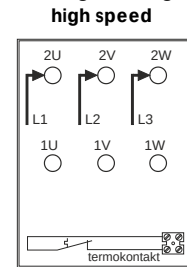
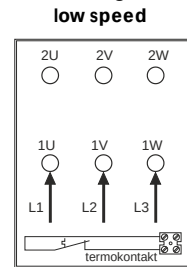
Two-speed motors with 4/2 and 8/4 poles switching are equipped with one winding and Dahlander Δ/YY wiring arrangement.

Two-speed motors with 6/4 poles switching have two windings and Y/Y wiring arrangement.



Dahlander wiring

for two-speed motors with 4/2 and 8/4 poles



Wiring using two independent windings

for two-speed motors with 6/4 poles

5.3.2. ELECTRICAL CONNECTION OF V-BELT DRIVE MOTORS USING FREQUENCY MODULATOR



- Proceed according to the guidelines outlined in the paragraph 5.2.1 – FAN'S ELECTRICAL CONNECTION USING FREQUENCY MODULATOR
- The initial performance curve of centrifugal fans with V-belt drive is defined by use of appropriate transmission ratio. In this case apply operating frequency 50Hz.
- In order to set up a different operating point, the frequency can be changed, however always downwards to lower frequencies (i.e. less than 50Hz). Should you require operating point placed on performance curve with frequency higher than 50Hz, please consult our local representative or service department of Janka Engineering as it is necessary to assess if the required operating point is not placed above the critical speed of the fan or inside the area of motor's overloading.

SAFETY PRECAUTIONS FOR WORK INSIDE THE FAN SECTION



- Follow safety rules and working procedures.
- Fan's impeller must be at complete stop during works inside the fan's chamber.
- Isolate electricity supply and secure from inadvertent re-connection. A state of no electricity supply to the fan must be established.
- Do not carry out any maintenance works when running impeller.
- Pay attention to abnormal operating noise.
- Check correct rotation direction of the impeller using the guiding arrow provided on the spiral case or impeller showing the correction rotation direction.
- After the fan stops running or during an electricity blackout the supply of system fluid into the heaters must be reduced so that the ambient temperature at the fan and motor does not exceed +40°C.

MOTORS' REMOVAL



- Relax the V-belt transmissions by releasing tensioning bolts on the sliders and disengage bolts holding the motor. After that the motor can be pulled out from inside the section.
- For manipulation with big motors (in units with sections' height 1,650mm and higher) a chain hanger can be used as described in the chapter 9.2.5. The chain hanger is not provided as a standard part of unit, it can be ordered as optional accessories, though.
- Chain hanger can be only used for manipulation with the motor, in no case for manipulation with the whole assembly of motor and fan.



Motor's removing mechanism

5.4. FANS WITH EC MOTORS

This section is intended for air to be drawn through it. High efficient radial fan modules with EC motors are used in this section. Each fan module is formed by free impeller with backwards curved blades and a diffuser. The fan is driven by motor with electronically commutated rotor including integrated electronics. Feeding voltage varies depending on the fan's type and can alternatively be 3x 400V/50Hz or 1x 230V (mostly smaller types with rated output up to 1,000W). The fan modules are set next to one another forming fan walls.

SAFETY PRECAUTIONS



- The device can be switched-on only when it has been properly installed and in compliance with its anticipated way of use.
- Risk of electrical shock. The terminals may be live even in case the fan is not running (fan is switched-on through control signal). Isolate the electrical feeding cable from the power supply on all phases before opening the terminal board. Wait five minutes (after the disconnection) until the capacitors become discharged.

INSTALLATION



- Installation and in-field electrical wiring must be carried out by professional installer.
- Apply only feeding cables, which comply with the required performance specification for the current drawn, voltage, insulation material and loading. Cable withstanding temperature up to 105°C are recommended. Always connect protection wire first.
- Actual wiring diagram is attached to the lid of terminal board.
- Install all cables clear of the rotating parts so that the cables cannot get in touch with them.
- When installing the cables, make sure the screw cable grommets are situated at the bottom of the terminal board and the cables are directed downwards. Water leakage into the terminal board must be prevented. Unused grommets must be capped off.
- Ventilation ductworks as well as all sections of the units must have all panels installed and access doors closed. Provide measuring of current drawn of the motors prior to the actual startup of the unit.
- Isolate electricity supply and secure from inadvertent re-connection while working on the fan.

OPERATION

- Make sure the fan does not suck-in any objects or sticky dust (for instance during startup running when no filters are in position yet or if used for temporary ventilation of unfinished building). The impeller has been statically and dynamically balanced in factory.
- Keep the ducting nearby the fan free and clear to avoid objects flying off the fan area drawn by the airflow.
- Operating temperature range is up to 40°C
- If one of the fans fails, the remaining fans carry on so the airflow is maintained.
- Motors have been equipped with overheating protection, detection of phase loss, undervoltage protection and short circuit protection.

SPEED CONTROL OPTIONS



- The basic speed control is provided by analogue signal 0-10V (4-20mA). The fan is permanently under voltage, but starts running only when control signal 0-10V is present on control terminals. The fan runs at maximum speed with 10V control signal. The fan is factory set for optimum operating parameters.
- Another option is to control the fan's speed by PWM digital signal.
- Motors with rated output exceeding 750W are equipped with communication interface RS485/Modbus. This feature allows in addition to the basic control option mentioned above real time monitoring of the fans' performance parameters (power input, speed, temperature etc.).
- Failures history can be read in the internal memory of the motor
- Since the fans with EC motors are mounted in parallel in the KLMOD units (being arranged in fans' walls), a partial back-up can be preset in the system in case one of the fans fails. As an example the remaining fans may increase their performance or similar provision can be adopted.

5.5. FILTERS

Filter section ensures filtering of the air drawn over the section from solid particles, typically dust. The filters capture and separate also aerosols, wet steam and snow. The section is used for filtering air. Pocket filters with filtration rating class G3, G4, F5 to F9, cassette filters of 48 mm length with filtration rating class G4 to F5 and metal filters, so-called grease separators furnished with aluminium drain pan installed may be applied. Special carbon filters are used to capture gaseous pollutants and odours. In addition, compact filters class F6 to F9, H10 to H13, combined filters with pre-filter and HEPA filters H10 to H13 are applied in the KLMOD units. Dimensions of the filter cartridges comply with the European standard.

INSTALLATION – Section with cassette, pocket, compact and HEPA filters

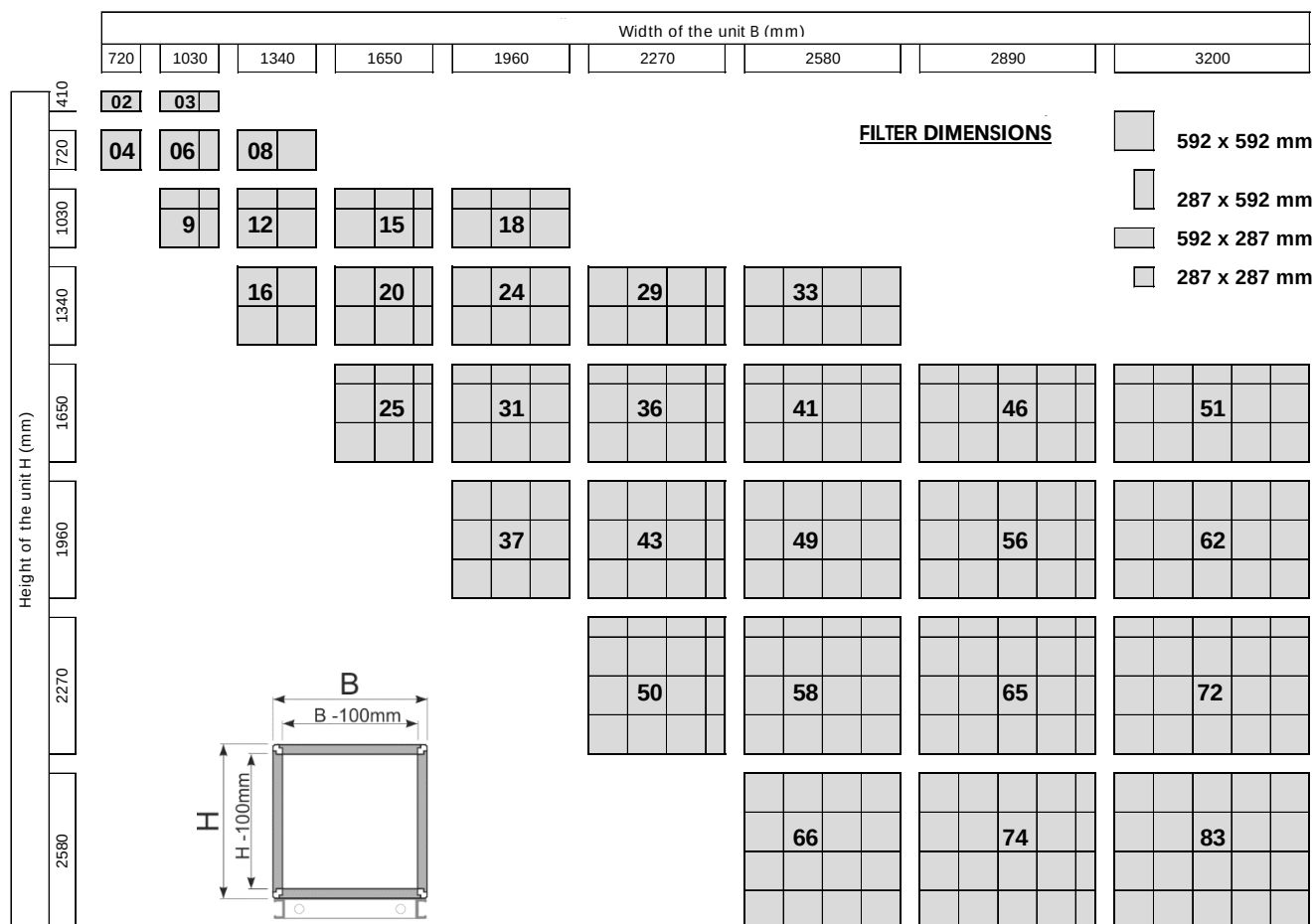
- The filtration cartridges are shipped wrapped inside the filtration section. They are to be set in position after the unit is fully assembled and the ventilation ductwork is cleaned.
- PLUG-IN FIXING – apply polyethylene self-adhesive gasket with protecting foil 3x6 mm or 4x8 mm in size on one vertical face of the plug-in cartridges. The gasket is part of the original delivery of filters. Plug the filter cartridges into the guiding rails and slide them towards the opposite side of the section.
- CLICK-ON FRAMES (RA) – filtration wall comprises of the click-on frames set together covering the whole unit's cross-section area. Pocket filters (short and long) and compact filters are attached to the filtration wall. Double frames are intended for combined double-filters. The filters are fixed to the frames by four fixing clips through micro-porous gaskets. Pocket filters G4 - M6 can be taken out in the airflow direction. Filters with higher filtration grade (F7 – H13) can be usually taken out towards the airflow direction, i.e. towards the soiled side. The actual way of removing the filters depends on concrete requirements of the project. No self-adhesive gasket is applied on the filters fixed by click-on frames as the gasket is part of the frame structure.
- Install differential pressure gauge for detection of filter's clogging on side panel of the section. Set the maximum permissible pressure loss for the filter type given following the information in table 1 – Overview of all filters used – pressure loss.
- When visual liquid pressure gauge is used, it must be filled an antifreeze liquid delivered together with the gauge.

OPERATION – Section with cassette, pocket, compact and HEPA filters

- The replacement interval depends on operating conditions of the unit. The filters become gradually clogged during unit's operation and they pressure loss gradually rises. The pressure loss is checked by readings on pressure gauge. Once the pressure loss reaches the value of clogged filter (see table 1), the filters must be replaced. It is recommended marking up the clogged filters pressure loss value on the gauge's sight glass.
- Set the **pressure loss of clogged filter** on the pressure gauge (see table 1) to allow signaling to the BMS system.
- Do not carry out regeneration (cleaning or purging) of the filters.
- Replacement filters can be ordered at the manufacturer of the unit.
- Apply new polyethylene gaskets 3x6mm or alternatively 8x4mm with protection foil on one vertical face of the frames when replacing plug-in filters.
- When replacing fabric pocket filters be careful not to confuse the filters with filters of different pocket length. Shorter pocket filters have lower absorption capacity. Use of longer pocket filters may result in protruding the filters into the adjacent section and danger of interception by the fan's impeller or burning in electrical or gas-fired heater.



5.5.1. Diagrams of filters' layout for various sizes of KLMOD units



Types of replacement filters are detailed in technical specification for the given filtration section:

	Type of filter and filtration grade				Filters' dimension	Quantity and ordering code
(2) Filtr	s	obslužný panel (Pravé)				
Udaje o filtru		Udaje o proudění				
Typ	Krátký kapsový filtr zasunovací	Průtok	10500	m3/h	Vyložení filtrů 592x287 592x592	2 (550 354) 2 (550 364)
Třída filtrace	G4	Poč./ Max. tl. ztr.	2,917	m3/s		
Celní plocha	1,04 m2	Vyp. tlak. ztráta	35/250	Pa		
Délka filtru	360 mm		142	Pa		
Příslušenství	- 1x Průchodky pro tlaková čidla (pár)					

Table 1 – Overview of all filters used - pressure loss

Filter's type	Filter's fixing	Filtration class EN 779							Filtration class EN 1822				Length of section (mm)	Length of filter (mm)	Pressure loss of clogged filter
		G3	G4	M5	M6	F7	F8	F9	E10	E11	E12	H13			
Metallic filter (grease)		☑											620	25	130 Pa
Cassette filter	U- plug-in	☑	☑	☑									310	50	300Pa
Short pocket filter	U- plug-in	☑	☑										620	360	250 Pa
Short pocket filter	U- plug-in			☑									620	360	450 Pa
Long pocket filter	U- plug-in			☑									620	500	450 Pa
Long pocket filter	U- plug-in				☑	☑	☑	☑					930	590-635	450 Pa
Short pocket filter	RA-click-on	☑	☑										620	360	250 Pa
Short pocket filter	RA-click-on			☑									620	360	450 Pa
Long pocket filter	RA-click-on			☑									620	500	450 Pa
Long pocket filter	RA-click-on				☑								620	590-635	450 Pa
Long pocket filter – takeout to soiled side	RA-click-on					☑	☑	☑					1240	590-635	450 Pa
Compact filter- aerosol	RA-click-on				☑								620	292-300	450 Pa
Compact filter	RA-click-on					☑	☑	☑					1240	292-300	450 Pa
Compact ultra-filter	RA-click-on								☑	☑	☑	☑	1240	292-300	450 Pa
Compact filter turned	RA-click-on					☑	☑	☑	☑	☑	☑	☑	1240	292-300	450 Pa
Com. cassette+pocket	2x click-on	☑	☑			☑	☑	☑					1240	50+625	650 Pa
Com. cassette+pocket	2x click-on	☑	☑			☑	☑	☑					1240	50+292	650 Pa
Ultra filter N (frame fixed by bolts)	NFG									☑		☑	930	292-300	600 Pa
NON-EXPLOSIVE UNITS															
Antistatic pocket filter	U-plug-in			☑		☑							930	500	300 Pa

Pocket filters - are made from synthetic or glass fiber media. The media is arranged in a form of sewn pockets. Frame is plastic; spacers are made of wood. Large filtration area and high dust trapping capacity. Filters are fixed to click-on RA frames or to plug-in U profiles. Fully burnable type or type with zinc-coated steel frame resistant to temperatures up to 100°C.

Grease filters – consist of several layers of aluminum weaved tissue inserted in aluminum frame, both sides protected by a stiff grill made of perforated metal sheet. These filters are intended for interception of grease containing aerosols present in the extract air from kitchens, bakeries, smoke boxes, grills or coarse industry dust.

Compact filters - consist of fiber-glass media folded to form V-shape elements inserted in plastic frame. Large filtration areas and high dust trapping capacity. Combustible without emissions. Fixed to click-on RA frame. Filters can also be turned and installed opposite to the airflow direction to reduce space taken by the filters.

Ultra filter N – Filters folded from sub-micron glass-fiber media and fixed in metal frames. Large filtration area and long service life. Fixed by embedding frame NFG. Filters intended for clean room applications in pharmacy, nuclear power stations and microelectronic industry.



Short pocket filter



Long pocket filter



Metallic filter (grease)



Compact filter



Ultra filter N

Overview of filters' layout in filtration sections – number of filters

Size of KLMOD	All filters cassette, pocket, compact and HEPA				Grease filters		
	Fixing of filter: U, RA, RS, HEPA				Fixing of filter: W		
	592 x 592 mm (pcs)	592 x 287 mm (pcs)	287 x 592 mm (pcs)	287 x 287 mm (pcs)	592 x 592 mm (pcs)	592 x 287 mm (pcs)	287 x 287 mm (pcs)
02	-	1	-	-	-	2	-
03	-	1	-	1	-	2	2
04	1	-	-	-	1	1	-
06	1	-	1	-	1	2	1
08	2	-	-	-	2	2	-
09	1	1	1	1	2	2	-
12	2	2	-	-	4	-	-
15	2	2	1	1	4	2	-
16	4	-	-	-	6	-	-
18	3	3	-	-	6	-	-
20	4	-	2	-	6	3	-
24	6	-	-	-	9	-	-
25	4	2	2	1	6	5	1
29	6	-	2	-	9	3	-
31	6	3	-	-	9	3	-
33	8	-	-	-	12	-	-
36	6	3	2	1	9	6	1
37	9	-	-	-	12	-	-
41	8	4	-	-	12	4	-
43	9	-	3	-	12	4	-
46	8	4	2	1	12	7	1
49	12	-	-	-	16	-	-
50	9	3	3	1	15*	5	-
51	10	5	-	-	15	5	-
56	12	-	3	-	16	4	-
58	12	4	-	-	20*	-	-
62	15	-	-	-	20	-	-
65	12	4	3	1	20*	5	-
66	16	-	-	-	20*	4	-
72	15	5	-	-	25*	-	-
74	16	-	4	-	20*	9	-
83	20	-	-	-	25*	5	-

Note: * sizes 50,58,65,66,74,83 have atypical access doors on grease filter sections

INSTALLATION – Section with metallic filters

- Metallic filters are fitted inside the section for shipping.
- The unit must be level.
- Drain pan including drain pipe ensures draining of the captured grease. The drain pipe is capped off by a plug at the standard unit. If the operator identifies grease accumulating in the drain pan, one of the following options can be chosen depending on the quantity of the grease and depending on the way the unit is operated:
 - Interrupted operation - operator determines the interval of opening the plug and draining-off the accumulated oil/grease into a suitable container according to the unit operation schedule
 - Permanent operation or excessive quantity of the captured oil/grease – install trap if it was part of the delivery (see). Design elevation “h” of the trap must be extended by approximately 20% for capturing oil due to the lower specific weight of the oil. After the trap is fitted, its proper function must be checked and the periods of its cleaning have to be set-up. Use a detergent dissolved in warm water of a temperature below 50°C for cleaning the trap.

OPERATION – Section with metallic filters

- The filters become clogged gradually during the operation by dust and have to be cleaned, preferably together with replacement of the textile filters.
- Cleaning of the metallic filters is achieved by knocking out the captured solid parts followed by rinsing in a solution of detergent in warm water. After that an additional rinsing of the filters by clean water (pressure cleaner) is carried out.

INSTALLATION – Section with active carbon filters

- Filter cartridges with active carbon are shipped separately. Install them after the unit is fully assembled and after cleaning of the entire ventilation system including air-handling units and ductwork.

OPERATION – Section with active carbon filters

- During the operation, the surface of active carbon filter cartridges becomes clogged and their sorption capacity gradually drops. The degree of saturation of active carbon can be determined by the increasing weight of the cartridge. Replacement of the cartridge is recommended at the point when the increase in weight achieves the maximum allowed values outlined in table 2 (approximately max. 1.2 times of the weight of the initial state of clean cartridge).
- Humidity above 70% is decreasing the sorption properties (at 90% humidity, the capacity of the filter is only 50%). In addition, air containing wet steam (100%) damages the casing of the filter cartridges by corrosion attack.
- Regeneration of active carbon in the cartridges is provided by their manufacturer.



Table 2 - Filters with active carbon cartridges – maximum allowed increase in weight

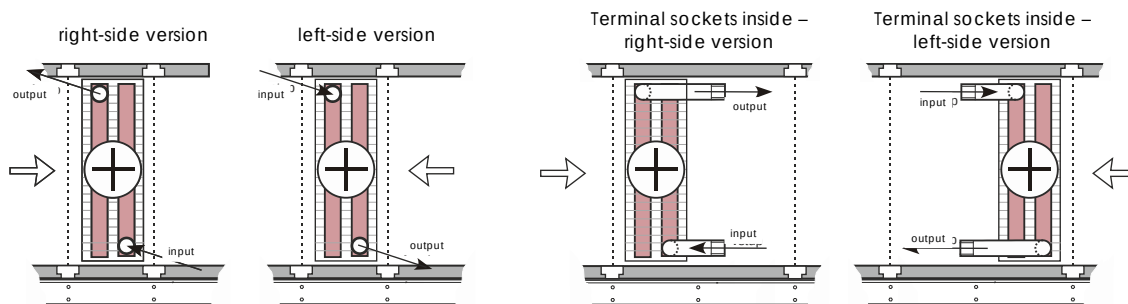
Cartridge filling	Efficiency of pollutants absorption	Absorption capacity (allowed increase in weight)
KS – SC40 for absorption of organic hydrocarbons and odours from the air	on average 60 - 75%	25 %
Special impregnated active carbon		
KS - KR1 for absorption of ammonia from gases and air	80 – 90%	20 %
KS - KC10 for absorption of acid gases and vapours from the air (particularly SO ₂)	60 – 90%	10 %
KS - J42 for absorption of sulphates in the air	85 – 90%	> 95 %
KS – HS10 for absorption of formaldehyde from the air	80 – 90%	20 %
KS – SQ21 for absorption of mercury vapour from the air and gases	95 – 98%	20 %
KS - CCA for absorption of phosphate from the air	90 – 95%	5 %
KS - RKJ 1 for absorption of radioactive methyl iodide	99%	12 %
KS – ZS10 for absorption of amines from the air and gases	75 – 80%	10 %

5.6. HYDRONIC HEATING EXCHANGERS

INSTALLATION



- Heating section is furnished with a label showing the required counter-flow connection of the hot water supply pipes to the exchange terminals. The counter-flow arrangement of the connection must be unconditionally observed.



Counter-flow connection of the heating exchangers

- When tightening the connection pipes to the exchanger apply a second spanner to hold firmly the terminal socket of the exchanger so that the torque force is not transferred onto the exchanger's structure.
- All pipes must be suspended independently from the exchanger. Weight or expansion forces of the pipe connections must not be transmitted onto the unit or exchanger. Line connections must be arranged in such a way that the forces induced by thermal expansion of the pipes do not cause excessive stress of the terminal sockets.
- It is recommended to fit temperature sensors onto the steel profile of the unit's sections. Each boring made in the steel profile must be properly sealed
- Capillary anti-freeze protection sensor must be placed downstream of the heat exchanger. Suitable location of the anti-freeze sensor is the metal parts of the supply side of the exchanger. Alternatively, the anti-freeze sensor can be place in a dedicated anti-freeze section of the unit.
- Anti-freeze protection must be also applied to units which are not under permanent operation such as back-up units. The recommended arrangement of anti-freeze protection protecting the exchangers from freezing during operation is shown in par. 5.7.
- Shutdown units must be protected against freezing by discharging water from all the parts of the unit. In order to achieve proper discharge of the water draining and venting valves have to be fitted on the line pipe in immediate vicinity of the terminal sockets. No other fittings are allowed on the pipe in the stretch between the exchanger and draining / venting valves.
- If there is no venting valve installed, it must be additionally fitted on the most elevated point of the hot water supply line.

OPERATION

- Check for proper function of the connections of the system fluids to the exchanger, closing valves and anti-freeze protection prior to start-up of the unit
- Bleed-off the exchanger during the startup procedure.
- If outside air temperature drops below +5°C, the system fluid supply to the exchanger must be open before the fan starts running. At the same time, the air temperature upstream of the fan must not exceed +40°C
- The maximum permissible temperature of the heating medium (water) is 110°C. The maximum operating pressure of the heating medium (water) is 2 MPa. All heating exchangers have been tested on internal pressure of 3 MPa.
- When the fan is not running, the hot water supply into the exchanger must be shut-off.

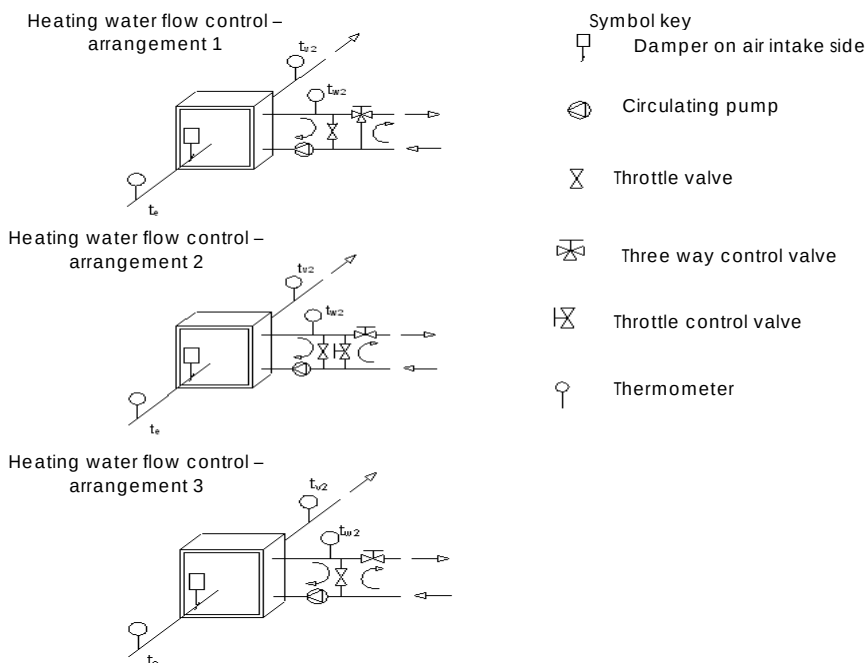


Water entering the exchanger must not contain any impurities that could cause clogging and scale deposits, in particular products of corrosion of steel and iron elements. To prevent occurrence of these impurities in the water it is necessary to use chemically treated water with parameters complying with the code ČSN 07 7401.

- Hydrogen exponent pH 7 – 9.
- Water hardness 1,0 mval.l⁻¹.
- Content of chlorides maximum of 30 mg.l⁻¹.
- The content of phosphates equivalent converted onto P₂O₅, min. 15 mg.l⁻¹.

Arrangement of heating exchanger control loop

- Make sure the design principles have been observed. The heating exchangers have to be designed without unnecessary capacity reserve. Oversizing increases the risk of freeze.
- Make sure all power devices including the BMS system components for control of anti-freeze protection are connected to backed-up power circuits.
- When mixing fresh outdoor air and re-circulation air, be sure the mixing occurs upstream of the exchanger. If the upstream mixing is not achievable, the cold outdoor air must be drawn through the upper part of the unit and outdoor air intake point must be as distant as possible from the heat exchanger.
- The first water heating exchanger, which is in immediate contact with the intake outdoor air, must be equipped with circulation pump, i.e. the exchanger's heating capacity control must be achieved by changing water temperature while maintaining constant water flow through the exchanger coil. Constant nominal flow of heating water prevents freeze-up during temporary temperature drop of the heating water compared to the design values or if the pressure drops in the heater's water coils differ. Also, the temperature profile on the exchanger face area is more uniform.
- It is necessary to monitor the outlet water temperature and the outdoor inlet air temperature on the exchanger
- Control components and circulation pump must be adequately sized.



Diagrams showing recommended arrangements of the heating exchanger's control loop

- Arrangement 1 and 2 provides for constant heating water flow through the exchanger and through building heating circuit line in all operating conditions.
- Arrangement 3 controls the heating capacity on the basis of water flow control through the exchanger and building heating circuits.

Important warnings



- **Warranty voids if exchangers damaged by freezing weather!**
- During shutdown of the unit in the winter season, e.g. in case of a power blackout, it is necessary to consider the danger of the exchanger's freeze
- Incorrect arrangement of exchanger's connections – for instance parallel connection instead of the required counter-flow connection arrangement leads to decrease in heating capacity by about 30%!
- The only reliable anti-freeze protection can be accomplished by application of a glycol mixture in the exchanger and line connections.

5.7. ANTIFREEZE PROTECTION

Air temperature probe positioned downstream of the exchanger:

- When using capillary temperature probes, the capillary is to be placed to cover the whole cross-section area of the active area of the heating exchanger. Location of the thermostat body must be chosen in such a way that the thermostat function cannot be influenced by the outdoor air. This can be achieved, for instance, by installing the thermostat inside a free section downstream the heating chamber (block). The capillary will be installed at the rear side of the exchanger forming regular diagonal loops across the tubes at a distance of 5cm. The radius of capillary bends should be at least 20mm. Use grommets when the capillary is passing through sharp bores in panels or webs of steel profiles.
- The stalk-type air temperature probe is placed at the bottom of the unit or ductwork. When the air temperature downstream of the exchanger falls down to +5°C the outdoor air damper shuts-off automatically until the cause of the temperature fall is identified and removed.
- If the air temperature downstream the exchanger keeps dropping down even further to +2°C the unit's operation is shut-off. The main pump on the heating water line remains operational.
- The unit may be restarted manually only after the cause of air temperature drop is identified and removed.

Outdoor air temperature probe:

- When the outdoor air temperature drops to +1°C, the circulation pump of the first exchanger must be switched-on regardless if the air-handling unit is running or at a stop. The main pump is assumed to run at the same time.

Heating water temperature probe:

- When the heating water temperature at the output from the exchanger falls down to +12 to +15°C the control valve opens the heating water supply into the exchanger to the maximum. When the heating water temperature at the leave of the exchanger rises to approximately +40°C the control valve returns to its original position.

5.8. STEAM HEATER

INSTALLATION

- Depending on the size the steam heaters are shipped assembled forming one shipment and assembly unit or split into several assembly units (applies for larger and heavier heaters).
- The system fluid used in the steam heater is saturated steam at a pressure of up to 1.7MPa (absolute) and temperature up to 200°C.
- The heater connection to the steam system shall be made by terminal sockets. The inlet terminal socket has larger diameter than the terminal socket of condensate drainage. The steam circuit must be perfectly sealed.
- The draining and venting valves are not included in the steam heater's delivery.
- The heaters operation condition must be monitored and secured on the inlet and outlet pipes so that the maximum allowable pressure and temperature will not be exceeded during heater's operation.
- Smaller air-handling units are equipped with one steam heater. Big air-handling units are equipped with multiple steam heaters, combined inside the section into one steam supply line and one condensate drain.

Operation

- Verify the connection of the system fluid to the steam heater's terminal sockets is correct, closing valves and anti-freeze protection function (as outlined in par. 5.6).
- Suitable condensate trap must be installed at the output of the heater.
- Once the steam heater is installed in the ventilation system, it is ready for startup. The steam heater is put into operation by opening steam valve on the supply line and by switching on the fan.
- As anti-freeze protection, it is recommended monitoring the air temperature downstream of the heater by a capillary thermostat (min. 5°C). At the same time provide for monitoring of the water temperature in the condensate pipe (min. temperature 10°C)
- Outdoor models of the air-handling units must be provided with anti-freeze protection on the steam supply line and condensate drainage line. This can be accomplished for instance by thermal insulation applied on the pipes supplemented by electrical heating traces.
- When the fan comes to a shutdown, the supply of system fluid into the heater must be shut-off.



5.9. ELEKTRICAL HEATER

Electrical heater's section is used for heating of air by means electrical heating rods. Heating rods are arranged as separately wired heating elements placed inside the electrical heater's section. Heating capacity is controlled by gradual switching of the heating elements or alternatively by modulating thyristor control system. Each heating rod element consists of one or more triads of star-wired 230V heating rods of 500W to 5kW heating capacity. Power supply cables terminate on terminal board installed inside the unit, where also terminal clamps of safety and emergency thermostats are installed. Each heating element is wired separately to 3x400V/50Hz power supply. Safety and emergency thermostat is wired as brake-type contact. Bushings are provided on the unit's casing at the terminal board ensuring safe passage of cables. Electrical cables are fed through bores provided with grommets in the unit's casing. Each electrical heater has been factory checked and certified in compliance with relevant Czech code.

INSTALLATION

- Electrical heater's performance data, including electric wiring diagrams, are included in the installation and operation manual, which is shipped together with the heater wrapped in a plastic pocket placed on the top panel of the section.
- Any work on the electrical heater can be carried out only by professional personnel authorized in compliance with the regulations ČÚBP and ČBÚ No. 50/78 Coll.



OPERATION



- The electrical heater must not be started unless the fan is running. Therefore the design of the control and electrical system must provide for switching on the electrical heater only when the fan is running. After stop of the electrical heater, the fan must keep running for at least 3 minutes to ensure good cooling of the heating rods. Failure to observe this condition, the manufacturer assumes no liability for damages caused by the heat accumulated in the body of electrical heater.
- If the filtering section with pocket filters is placed downstream of the electrical heater, check for any defect of the filters and observe for sufficient distance between the filters and heating rods!
- The safety and emergency thermostats must be properly wired in the control system. The electrical heater must be stopped when the thermostats' contact opens. The safety thermostat is reset automatically at the point the heater cools down. The emergency thermostat needs manual reset. The temperature must fall below the value set on the emergency thermostat between the thermostat's overheating and manual reset. The condition for reset of the heater is the removal of the cause of overheating. The safety thermostat is set on temperature of 75°C as standard; the emergency thermostat is set on temperature approximately 120°C.
- The airflow velocity in the effective cross-section of the unit **must not fall below 1.5 m/s**, otherwise the heating rods become overheated. Units with variable airflow have to provide for setting of higher minimum speed (see settings of frequency modulator).
- The air temperature on the air leaving side can be **maximum 50°C**. Special design of the electrical heater must be ordered if higher air temperature is needed.
- Standard electrical heater must not be placed in an environment with explosion risk. No explosives or flammable materials are allowed to be stored nearby the electrical heater.

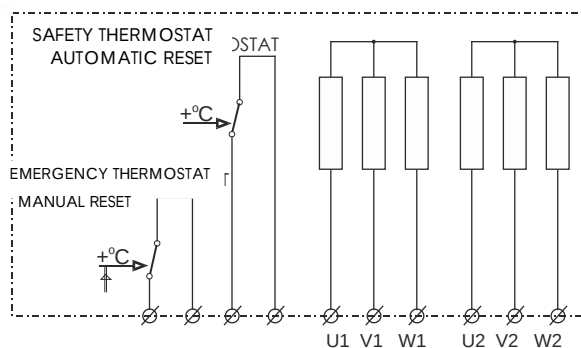


Fig. 11 Example of electrical heater wiring

5.10. GAS-FIRED HEATER

Gas-fired heater provides heating of air drawn over air-conditioning units by combusting gas.

Depending on the burner type applied, natural gas, coal gas, propane-butane, fuel oil or light fuel oil can be alternatively fired in the burners.

The gas-fired heater section is always furnished with a set of certificates and mandatory documents as required by valid codes applicable for gas-fired equipment operation. These documents are shipped under separate cover:

THE DOCUMENTATION ATTACHED INCLUDES:

- o Warranty certificate.
- o Certificate on putting the exchanger component of the heater into operation – to be completed by authorized personnel of the installer, who inspects for correct wiring of safety devices, dampers' function, workmanship of the installation works etc.
- o Certificate on quality and completeness of the product, i.e. Certificate of product's routine test. This certificate confirms technical and performance parameters of the heater.
- o Certificate No. E -30-00663-02-rev.1 (gas-based fuels) or B-30-00664-02 (liquid fuels) SZÚ Brno
- o Certificate of conformity
- o Recommended wiring diagram
- o User's manual for ESD3J thermostat
- o Dimensional drawing of exchanger's parts of the heater
- o Further information: handing and shipment conditions for air heaters, product's description, installation manual, operation manual, maintenance manual.

TECHNICAL SUPERVISION AND CHECKS

Gas-fired equipment is subject of mandatory checks, in particular the Type checks and the Product checks.

Type checks – are performed by Strojírenský zkušební ústav Brno s.p., testing laboratory No. 202, Hudcova Street 56b, 621 00 Brno and apply to the given type of equipment.

Production checks, i.e. Certificate of product's routine test – are performed on each produced exchanger part in the factory. The production checks include following inspections:

- Inspection of housing welds
- Inspection of exchanger welds
- Inspection of external connection dimension
- Inspection of surface treatment
- Inspection of completeness of the equipment and its accessories

Technical supervision is carried out by Strojírenský zkušební ústav Brno according to the directive No. 2009/142/EC (corresponds to government regulation No. 22/2003 Coll.) Annex II. Par. 2.3. The supervision is fulfilled on the basis of random inspections.

GENERAL DESCRIPTION

The gas-fired heating section consists of combusting chamber and gas-fired burner. The combusting chamber is a welded metal box constructed from several metallic materials (steel grade 11, heat resistant materials and stainless steel) in order to assure as long as possible technical life of the chamber. The front side of the exchanger is provided with a flange for connection of burner. The combustion fumes are extracted from the exchanger section through fume flues to chimney. The air is drawn along the combustion chamber and through the chamber's tube sheet, whereby the air is heated. The external casing of the section is made of standard panels of the KLMOD unit, the steel profiles used exclude plastic lining to achieve higher heat resistance. Each exchanger part is on the hot air leaving side furnished with a triple thermostat (T1, T2, T3), which must be wired into the electrical control circuits of the complete heater ensuring safe operating of the heater. The thermostat is not intended for control of required temperature of the leaving air. The gas-fired heating section is equipped with dampers for control of airflow drawn through the combusting chamber, so called by-pass. These dampers are to be preferably controlled by actuators. The heater is equipped with condensate drainage for draining the combusting chamber (½" pipe). The gas-fire heaters come in both indoor and outdoor design. The indoor heaters with IP 40 protection rating can be used in normal basic environment. The outdoor heaters with IP43 protection rating are intended for outdoor applications. The burner and thermostat are protected with a cover from the weather.

When the gas-fired heater is applied in the unit, the airflow and heat load must be maintained at the required values as specified in the technical documentation, on the production label and in the contract of purchase.

Correct function of the gas-fired heater can be guaranteed only when the following operating conditions are adhered to:

- Nominal heat load (kW)
- Nominal airflow (m³/hour)
- Appropriate gas pressure and gas flow (see the documentation)
- Correct air temperature on the inlet side (typically, at standard design up to 40°C)
- Proper by-pass of the combusting chamber must be provided
- Chimney effect and short-circuiting of the intake air avoided
- Correct wiring of the thermostats T1, T2, T3
- Compliance with the outdoor / indoor environment for the application given.

INSTALLATION

- The gas-fired heater must be installed on a level, structurally adequate floor or base frame. Unevenness of the floor surface must not exceed 5mm measured across the exchanger width.
- Positioning of the gas-fired exchanger must allow for cleaning of the tube box and potentially replacement of the combusting chamber. The clearance required for ordinary maintenance is 600mm on the service side as a minimum. Big heaters (heating capacity approximately 500kW and more) provided with access opening at the rear side require additional 600mm clearance at the rear side. A minimum clearance equal to the width of the unit plus 200mm must be provided on the service side of the unit for removing the combusting chamber.
- Check the bolts holding the combusting chamber at the burner's side for tightening. The covering panel on the tube sheet (opposite the chimney) must be kept clear to allow for removing when cleaning the tube sheet.
- Observe the required safety distances. The actual safety distance between the gas-fired heater and a flammable material must not be less than 200mm as stipulated in the code ČSN 061008:97. If the safety distance cannot be observed, a protection screen made from a nonflammable material grade A or B must be introduced. The thickness of the screen must be at least 3mm. The screen must be fixed in a steady position between the heater and the protected material at a distance of 30+5mm from the protected material. The protection screen must overlap over the protected material to the nearest wall or ceiling structure, but the minimum overlapping must be 300mm on the top side and 150mm at the sides. If protection screen is used, the required distance can be reduced to one half at the most.
- When the gas-fired heater is installed on a flammable surface, an insulation nonflammable pad is to be applied under the heater. The material of the pad must be nonflammable grading A or B and must be resistant to mechanical load. Dimensions of pad must be at least the same as the footprint dimensions of the heater. The minimum thickness of the pad is 5mm.
- No flammable liquids can be stored nearby the gas-fired heater. Failure to follow this instruction may result in risk of fire.
- The gas-fire heater is to be installed in the air-handling unit in a manner that optimal by-pass of the air flowing over the combusting chamber is achieved.



Connection to fume flues (chimney)

- The fume flues installation must comply with all the applicable codes and must be carried out by authorized installer.
- Static pressure at the fume flues throat can be 0 Pa.
- Condensate drainage from the fume flues and exchanger area is absolutely imperative.



Installation of the burner

- The exchangers are equipped with pressure burners suitable for operating with relevant heating fluid. One-stage, two-stage or modulated operation control for the burners is provided. The burner is not included in the exchanger shipment split. Burner is shipped under separate cover.
- User's manual delivered along with the burner applies to burner installed.
- Make sure the bolts on the burner's flange are tightened prior the burner's installation.

- The connection line of the heating fluid must be installed by an authorized, professional installer (following the designed arrangement) and must comply with codes applicable for operation of the burner's type used.
- The gas pressure regulating set pertinent to the burner is to be installed in a manner so that it does not obstruct removal of the tube sheet service panel and smooth cleaning of the tube sheet is possible.
- Installation and setting up of the burner is to be carried out by service personnel of the burner's manufacturer. The burner is ready for final approval by local authorities at the installation side and operation after submission of certificate of burner's setting-up and submission of inspection certificate.
- The exchangers are equipped with flanges and gaskets for bolted connection of the burner as standard. The outdoor model of the exchanger includes rain protection cover.
- Heating trace is recommended for outdoor model to heat the burner TKW 53/TKW 58 (optional accessories). The heat trace protects the burner's actuator from freeze when it is switched off. Heating trace is to be coiled around the multi block (or alternatively around the gas pressure regulator) and is fed through grommet under the burner's cover where it is coiled around the motor. Control thermostat of the heat trace is to be placed in the vacant corner at the bottom of the burner's casing. The thermostat is to be set on +5°C. Electrical supply to the heat trace is ensured from the burner's terminal box and is achieved by inserting the cable connector between seven-pole connectors of the burner's plug.
- Prior the installation check for compatibility of local conditions of the fuel lines, fuel properties, pressure with heater's actual setting.

Electrical wiring

- In-field electrical wiring must be carried out by authorized professional company including submission of a final check certificate of the electrical installation in compliance with the code ČSN 33 2000-6-61.
- Keep the covering panel of the tube sheet clear from any object obstructing removal of the covering panel.
- The gas-fire heaters are delivered excluding electrical control. The gas-fired heater is only provided with one triple thermostat at the air leaving side. The triple thermostat contains the following thermostats:
 - o T1: safety, break-type contact. Not reversible. Manual reset necessary
 - o T2: operating, break-type reversible thermostat
 - o T3: fan's switching thermostat
- Safety thermostat contact T1 must be wired in the burner's electrical supply phase line so that the burner's shutoff is assured at any operating (even failure) status of the burner.
- Operating thermostat contact T2 is to be wired in the circuit of burner's terminals T1 and T2 and shutoff burner's operation when temperature rises above the set value.
- Fan's thermostat contact T3 ensures switching-on of the fan and its after-running needed for combustion chamber cooling after the shutoff of the burner. The fans must be wired so that they cannot shutoff prior to the opening of T3 thermostat contact.
- The triple thermostat is provided with a rain protection cover on the outdoor model of the heater.
- The gas-fired heater is provided with a terminal for fastening of protection grounding wire in compliance with the code ČSN 32 2000-4.41.
- PE grounding wire must be necessarily wired to the "ground" terminal on the triple thermostat ESD3J so that effect of induced voltage on proper functioning of the thermostat is ruled out.

Control

The combustion chambers come equipped with Weishaupt burners (in some cases different brand name is possible) with two-stage or modulated capacity control. Therefore the burners' control can be two-stage on the basis of thermostats (on/off, 1st /2nd stage) or modulated through PI regulator depending on the room temperature.

The combustion chambers include by-pass casing splitting the airflow between the exchanger and the by-pass duct. The by-pass allows accurate control of the air on the heater's leaving side and optimizes efficiency of heat transfer. The by-pass including damper is integrated in the heater's section. The damper is controlled by actuator (actuator is not part of delivery).

A free section of adequate length must be always arranged upstream of the bypass chamber in order to achieve uniform split of the air flow drawn through the exchanger and through the bypass.

Recommended control logic: The gas-fired burner's capacity is controlled on the basis of room temperature required. The bypass dampers control proceeds according to the flue gases temperature so that overheating of the chamber and flue condensation does not occur. The ideal situation comes when flue temperature of 160°C is maintained by opening the bypass damper. The ideal temperature value depends

for a part on the exchanger's size. It may be slightly lower, but excessive condensation must not occur. When the flue temperature rises, more air must be drawn through the exchanger and vice versa. Consider the speed of opening dampers during startups of the burner in order to avoid overheating of the exchanger.

The burner must be wired so that it cannot operate unless fans are on and air is flowing over it.

OPERATION

- Tripping of the safety thermostat T1 is to be monitored during heater's operation. When the maximum temperature setpoint set on the triple thermostat placed optionally on the left of on the right hand side above the burner is exceeded (100 to 120°C) the burner's operation is blocked off. Automatic restart of the burner is only possible when the tripping on the triple thermostat is manually reset. Temperature must drop under the setpoint value set on T1 thermostat before the triple thermostat reset. The condition for reset of the heater is removal of the cause of overheating.
- The electronic thermostat applied allows for remote reset of the T1 safety thermostat (for instance through a push button installed on control box door). This possibility is an advantage when the gas-fired heater is located in difficult accessible areas (for instance high-level installation under the ceiling).
- If there is blackout on the power supply line during burner's operation the temperature rises inside the exchanger's chamber due to the accumulated heat and not functioning fan. If the temperature reaches the setpoint value set on the T1 safety thermostat the thermostat trips and disconnects voltage supply to the burner. The electronic thermostat resets automatically when the power supply line is back providing the temperature drops under the setpoint value (in the case of prolonged blackout). At a short-term blackout it is necessary to wait until the chamber is cooled down by the air blown by the fan and make manual reset after that.
- Once the heater is put into operation by professional installer, the parameters set cannot be altered so that faultless operation of the equipment is ensured.
- The gas-fired heater must not be installed in an environment with risk of explosion.
- The gas-fired heater must not be switched on and operated unless the fan is operating.
- Sudden shutoff of the equipment (burner and fans) is not permitted. The wiring must provide for after-running of the fans to ensure cooling of the exchanger. The heat accumulated in the exchanger may cause damage to the adjacent equipment due to airflow!

5.11. HYDRONIC COOLING EXCHANGER

INSTALLATION

- Cooling section is provided with a label showing the correct counter-flow connection of the chilled water supply lines to the exchange terminals. **The counter-flow arrangement of the connection must be unconditionally observed**

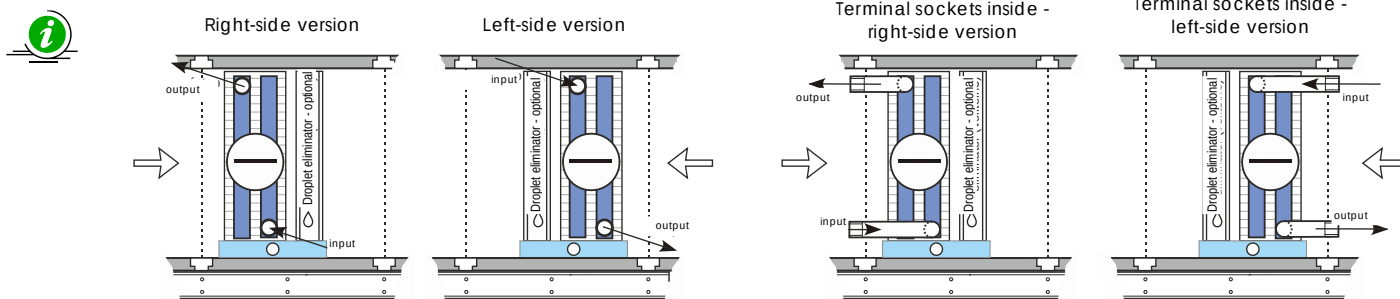


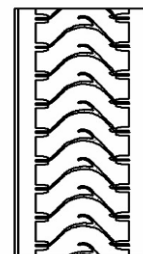
Fig. 12 Counter-flow connection of the cooling exchangers

- When tightening the connection pipes to the exchanger apply a second spanner to hold firmly the terminal socket of the exchanger so that the torque force is not transferred onto the exchanger's structure.
- All pipes must be suspended independently from the exchanger. Weight or expansion forces of the line connections must not be transmitted onto the unit or exchanger. Line connections must be arranged in such a way that the forces induced by thermal expansion of the pipes do not cause excessive stress of the terminal sockets.

- Majority of the cooling sections include droplet eliminator, which intercepts condensate droplets drifting in the air at higher airflow velocity inside the chamber. It is necessary to observe correct orientation of the eliminator when removed from the section and returned back (see

Important notice

- the arrow shows correct direction of airflow)
- Check for the position of the eliminator - it must always be installed downstream of the cooling exchanger
- Installation of temperature sensors is recommended on the steel profiles of the sections. Each bore done in the steel profile must be sealed off properly.
- Shutdown units or units designed for summer operation only furnished just with the cooling section must be protected from freeze by discharging water from all parts of the unit. In order to achieve proper discharge of the draining and venting valves have to be fitted on the line pipe in immediate vicinity of the terminal sockets. No other fittings are allowed on the pipe between the exchanger and draining / venting valves.
- If there is no venting valve installed, it must be additionally fitted on the most elevated point of the chilled water supply line
- Following discharging the exchangers, the residual water has to be removed by pressure air.
- The direct expansion exchangers are intended to work with specific refrigerants specified by the manufacturer. The specified refrigerant must be used so that the cooling capacity and correct function of the equipment is ensured.



Correct orientation of the droplet eliminator – top view



5.12. DIRECT EXPANSION (DX) EVAPORATOR

- Direct expansion evaporators are always designed and manufactured bespoke for given application, i.e. for a concrete condensing unit and airflow value. In combination with a different condensing unit the DX evaporator may not be functioning correctly. The DX evaporator come in left hand and right hand side versions depending on location of the connecting copper refrigerant pipes.
- The DX evaporator coils are filled with nitrogen in factory.
- The cooling source (compressor unit) is not part of the equipment delivery.
- Connection of the refrigerant circuit pipes must be carried out by an authorized professional installer. Refrigerant leakage test must be performed on the refrigerant circuit. This test is to be carried out by authorized personnel holding relevant certificate as required by the law.

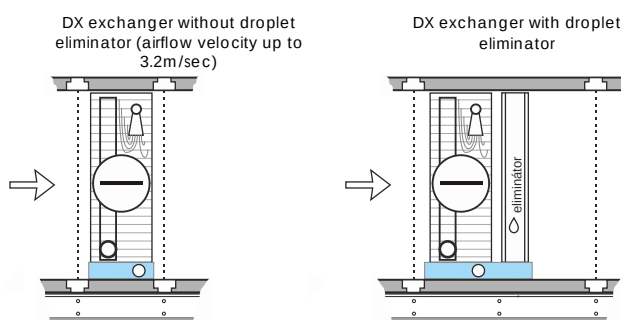


Fig. 13 Connection of DX evaporators

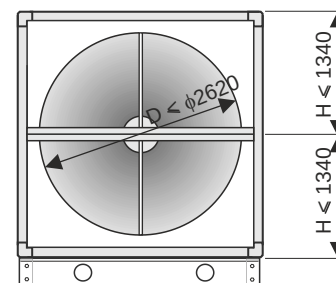
5.13. ENERGY RECOVERY WHEEL

The energy recovery wheel may be shipped by ordinary transportation means. The energy recovery wheel must be in vertical position during shipment (i.e. axis of rotation of the wheel must be horizontal). The wheel must be secured from turning over and damage.

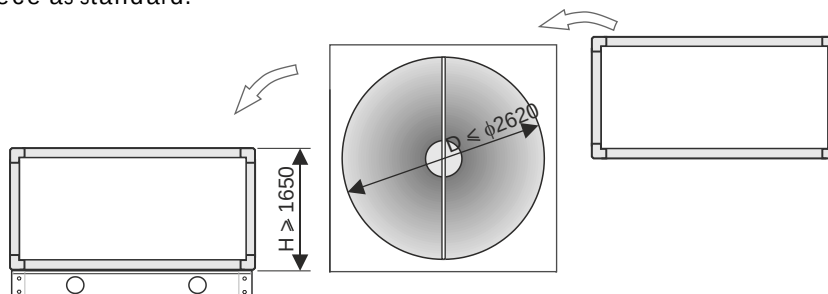
Protection during shipment is carrier's responsibility. In case of improper handling and noncompliance with shipping conditions no warranty claim may be admitted and the manufacturer is not bound to warranty conditions for the product.

ENERGY RECOVERY WHEEL MODELS

1/ Small one tier units of height up to 1,340mm come with the wheel section assembled in one piece in the factory. The wheel sections which are not protruding the side line of the unit are fastened by standard external clamps to the adjacent sections. ROV sections protruding the side line of the unit are fastened by standard internal clamps to the adjacent section.



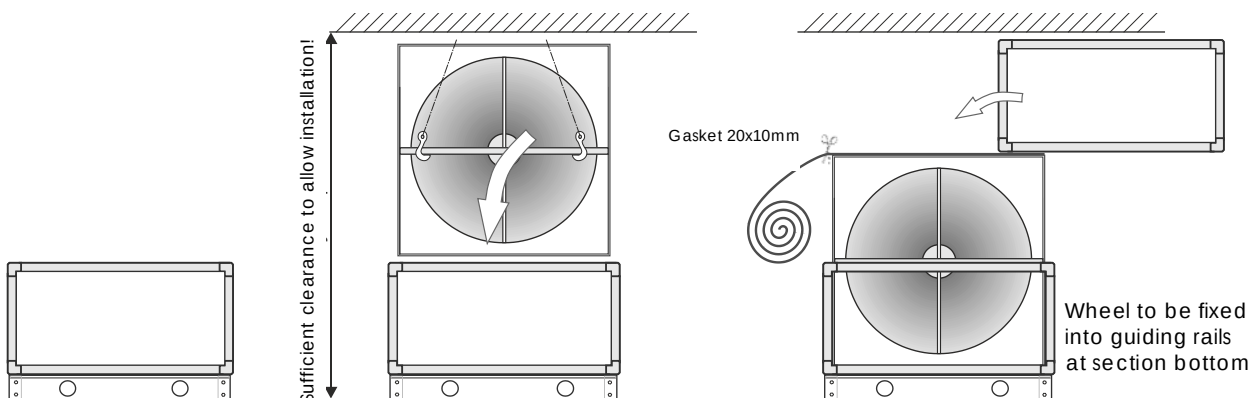
2/ Larger units of tier height from 1,650mm onwards come with the energy recovery wheel section split for shipment into bottom part, upper part and the actual wheel assembly. The installer will erect the section and fit the wheel on site. Wheels of diameter up to 2,620mm are shipped in one piece as standard.



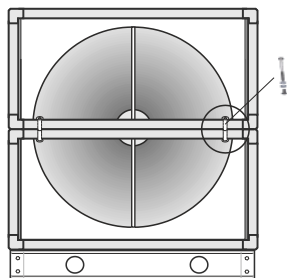
3/ Big wheels of diameter from 2,850mm onwards are always unassembled for shipment. The wheel is shipment split into 4 or 8 sectors of circle, the framing is shipment split into 2 or 4 parts. The wheel is assembled in field by JANKA ENGINEERING service department.

ASSEMBLY OF HEAT RECOVERY WHEEL WITH DETACHED CASING FOR SHIPMENT

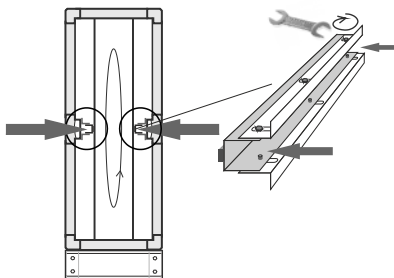
One tier units of tier height from 1,650mm onwards come with heat recovery wheel section split into bottom part, top part and the wheel component itself for shipping. The installer will assemble the sections in field and erect the heat recovery wheel.



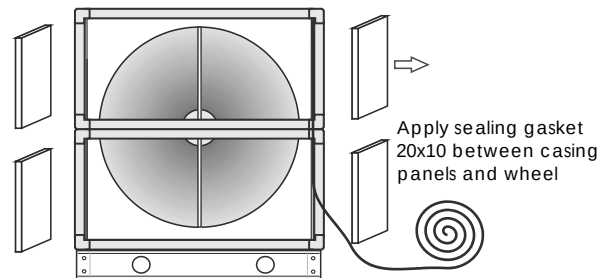
1/ Set the bottom part of section in final place of installation



2/ Pull-in the wheel component into the section from the top



3/ Inset the top part of unit casing

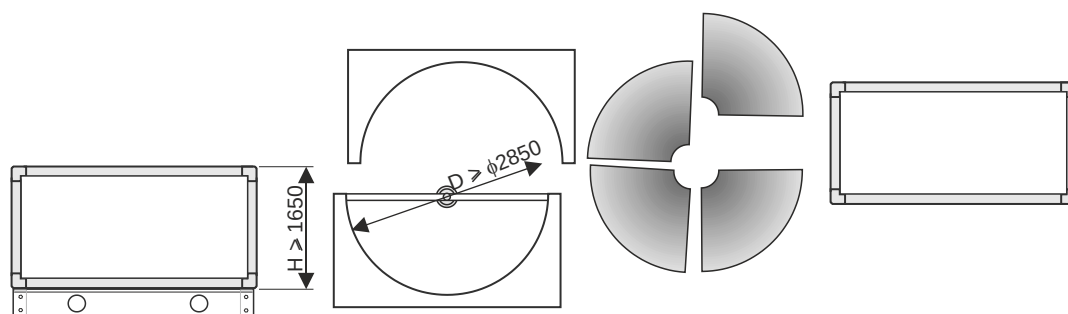


4/ Bolt the casing parts together by M8x100 bolts

5/ Push firmly the sealing profiles onto the center of the wheel and tighten bolts in oval grooves wheel and panels and put back the panels

6/ Remove casing panels, apply sealing gasket between

INSTALLATION



- Ensure correct belt tension before the first startup.
- In case the rotor is furnished with shipment brackets remove them prior to installation.
- Check cleanliness of revolving and fixed parts. Clean thoroughly potential metal chips.
- Verify smooth rotor revolving.
- Check for correct adjustment of sealing components of the rotor (pressure spring, sealing caulk).

Field electrical wiring must be carried out only by authorized personnel.

OPERATION

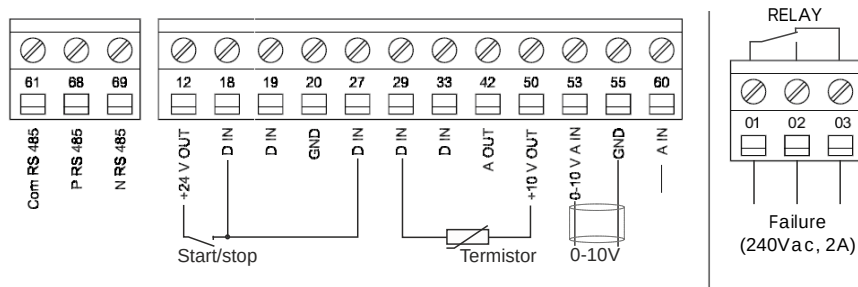
- Check for correct rotation direction of the rotor prior to first startup. In case the rotor is rotating in wrong direction, the phases on electrical cable between frequency modulator and rotor's motor must be changed.
- Verify correct function of sealing components on the rotor and adjust after several operating hours.
- Current drawn by the motor must not exceed the rated value indicated on the motor's plate.

RECOMENDED WIRING AND SETTINGS OF DANFOSS FREQUENCY MODULATORS

Follow the installation information provided in the frequency modulators' installation manual.

Wiring of terminals of Danfoss FC 51 frequency modulator:

- 53 towards 55 control signal 0 to 10V
- 12 towards 18 remote start/stop
- 51 towards 29 motor's thermistor
- 01 - 02 - 03 normal operation / failure signal to BMS system



Recommended settings of frequency modulator FC51 for wheel drive control

- 1-20 motor's rated output – according to motor's plate
- 1-22 motor's voltage - according to motor's plate
- 1-23 50Hz – nominal motor's frequency - according to motor's plate
- 1-24 current drawn by the motor – according to motor's plate
- 1-25 nominal motor's speed - according to motor's plate
- 3-02 15Hz – minimum frequency
- 3-03 50Hz – Operating frequency as given in the specification
- 3-15 analogue 53 - (control signal 0-10V)
- 3-16 0 – no function allocated
- 3-41 10s acceleration time
- 3-42 10s deceleration time
- 4-10 0 - clockwise (do not change rotation direction)
- 4-12 15
- 4-14 50Hz - frequency for the application given
- 6-10 0V
- 6-11 10V
- 6-14 0 Hz (frequency at 0V)
- 6-15 50 Hz – operating frequency at 10V
- 1-90 2 - (thermistor overheating switches off frequency modulator)
- 1-93 6 – thermistor is on input 29

1-62	0 – slip compensation
2-17	2 – switched on – overvoltage control during start
5-12	2 – free inversion after-run
5-13	0 - no function allocated
5-40	9 - ALARM – failure relay function

5.14. CROSS-FLOW HEAT RECOVERY EXCHANGER

The cross-flow plate heat recovery exchanger yields heat energy from the return air, whereas the return and fresh air airflows are completely separated. The cross-flow heat exchanger is inserted in the section and its edges are sealed with silicon-free sealant. The section has a bypass at the fresh air intake side providing ice build-up as a result of condensate water freezing on the exchanger's surface. The by-pass is provided with a damper including a shaft for actuator drive installation. The section includes a condensate pan. The section may be further furnished with an air mixing damper integrated in the bypass allowing for mixing of the return and fresh air. This feature is useful if there is a call for quick response to ensure prompt heating in building. The mixing damper includes a shaft for actuator drive installation.

INSTALLATION

- Apply a gasket on the face of the cross-flow heat exchanger to assure seal after the sections are pulled together and secured as described in detail in the par. 4.6 – Connecting section.
- Bigger sizes of cross-flow heat recovery exchangers are split for shipping. Mounting material pack is included in the delivery (connecting material, clamps, rivets, gaskets, silicon-free sealant). The sections must be assembled in field as it is not possible to handle them once they are secured together. Sufficient space should be available for the assembly works. The question of cost of the assembly works is dealt with in the contract of purchase. Sections split for shipping are accompanied with a specific addendum to the installation manual.
- Apply suitable actuator drive on bypass shaft
- When the cross-flow exchange includes integrated air mixing feature, it is necessary to apply suitable actuator drive or manual lockable lever on damper's shaft.
- The condensate drain pan (at the connection nipple) requires trap and the condensate must be drained off to a building drainage line.

OPERATION



- Make sure the actuator drive is set correctly on the bypass damper shaft. The damper's shaft has an adjustment line stamped on it indicating correct orientation of damper's blade. The adjustment line and damper's blade must be parallel.
- Freezing of the extract air in the cross-flow heat exchanger must be avoided. The extract air may freeze inside the cross-flow heat exchanger when outdoor air temperature falls below freezing point because heat is yielded from the extract air and this may lead to its freezing up inside the cross-flow heat exchanger. This may further lead to reduced airflow over the exchanger resulting in build-up of ice and eventually to damage of the exchanger. To avoid this, proper function of the bypass damper must be ensured.

Function description: freezing of the extract air is reduced through gradual opening of the bypass on the fresh air side. This results in the ice built-up defrosting and subsequent blowout of water from the exchanger into condensing pan.

- Risk of extract air freezing (and signal for bypass opening) may be assessed by following basic technical means:
 - o Monitoring of pressure drop on the air leaving side of the cross-flow heat exchanger
 - o Monitoring of air temperature drop on the extract air leaving side of the cross-flow heat exchanger.



5.15. HEAT RECOVERY GLYCOL CIRCUIT

The heat recovery glycol circuit is designed for heat recovery by means of two separate heat exchangers (cooling exchanger and heating exchanger) mutually connected by piping lines. System liquid is circulated in the piping lines by circulation pump providing transfer of heat energy from one exchanger to the other. Major advantage of this arrangement is the absolute separation between the fresh air and extract air. In addition, this arrangement provided the possibility of installing the supply air part and return air part of air-handling unit separately in completely different areas.

- Standard delivery contains only heat exchangers in the supply air and return air parts of the air-handling unit. Copper tubes and aluminum finning is used in the exchangers as standard.
- The delivery scope does not provide for connection piping between the exchangers and hydraulic circuit equipment such as circulating pump, expansion vessel, fittings etc.

INSTALLATION AND OPERATION

- General guidelines outlined in the chapter "Water heaters" are applicable for installation, operation and cleaning of the exchangers.
- Antifreeze protection of the heat recovery glycol circuit is ensured by the anti-freeze system fluid in the circuit (for instance glycol or similar fluid which does not attack copper tubes by corrosion). Concentration of the anti-freeze mixture must comply with the lowest operating temperature of the outdoor air, i.e. the winter extreme temperatures.

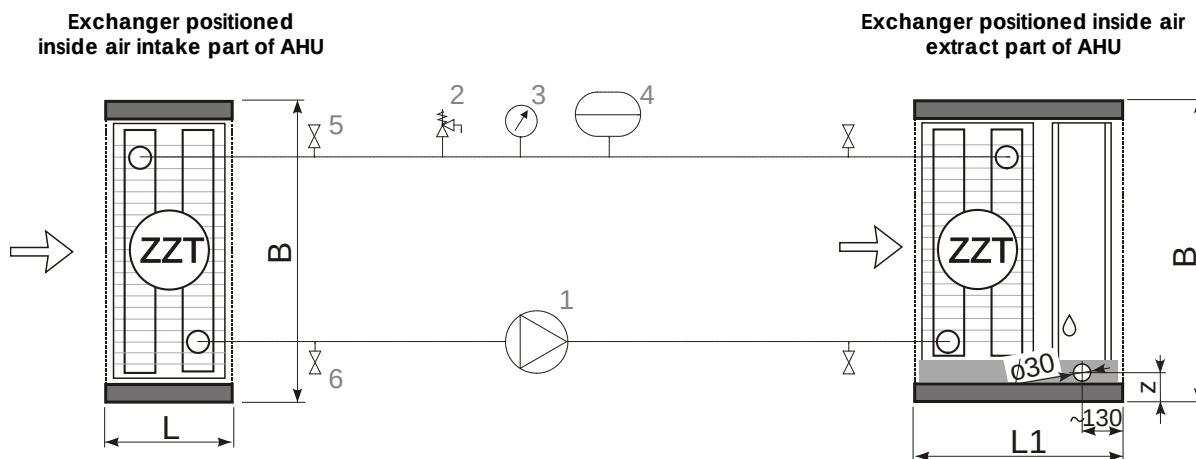


Fig. 14 Example of glycol circuit arrangement

1 – circulating pump 2 – safety valve, 3 – pressure gauge, 4 – expansion vessel
5 – venting valves, 6 – draining valves

Note: fittings on the connecting lines and circulating pump are not included in the delivery

5.16. NOISE ATTENUATING SECTION

The section is attenuating airborne noise generated during operation of air-handling unit. Acoustic baffles attenuating airborne noise are fitted inside the section. The baffles are constructed from zinc-coated metal sheet casing padded with acoustic fill made from noise absorbing material. The baffles are mutually interconnected forming a compact block and inserted into the section by means of perpendicular guiding rails.

INSTALLATION AND OPERATION

- Assembly of the noise attenuating section is usually provided by the manufacturer. The section is shipped assembled in one piece. For installation of the noise attenuating section follow the general instructions for installation of sections.
- This section does not require any operating maintenance.
- The whole attenuating baffle block may be pulled out to the service side for cleaning after removal of side panels and removal of demountable partition.

5.17. DISPERSE HUMIDIFICATION SECTION (AIR-WASHER)

Check for visible shipment shortage or damage to the air-washer immediately after delivery. Any damage identified must be immediately reported to the vendor so that negotiation on settlement of the shipment damage claims may be commenced with the insurer.

Thermoplastic materials (PP, PE, PA) applied on the equipment are very resistant to mechanical damage, however prone to damage by sudden shock stress in particular at the joints' area where rigidity typically found at steel based materials is not reached. Therefore the air-washer must be handled with utmost care especially avoiding twisting of its structure. Some fragile parts are unassembled and shipped loose at bigger sizes of air-washers. Be careful when mounting and handling the equipment in field (in particular when handling pipes, nozzles' holder and droplet eliminator). Pay special attention when working at ambient temperature below 5°C. In this case, it is recommended appointing the manufacturer or his representative with the in-field assembly. Adhere strictly to the cautions shown on the shipment wrapper. ATTENTION: idle run of the pump is not allowed!

INSTALLATION

- Remove thoroughly all dirt and debris from the air-washer interior occurred during shipment and installation. Potential damage to the air-washer or pump caused by soiling of the equipment at the job site will not be accepted as warranty claim.
- If the pump was shipped loose, attach the bracket to the air-washer and fix the pump to it.
- Check for perfect fixing of the pump's suction sieve, suction openings must be turned to the bottom.
- Check for perfect fixing of nozzles' holder and nozzles.
- Provide power supply to the auxiliary electrical panel on the air-washer. The electrical panel includes ground fault protection, wiring of the HRH-5 floater and air-washer interior lighting including circuit breakers. Power supply line 1x230V/50Hz must provide for circuit breaker of adequate size. The power supply line to the electrical panel must comply with applicable regulations.
- Connect power supply to circulating pump. Electrical wiring diagram and supply voltage required is provided on identification label of the pump. Power supply line must include adequate circuit breaker and pump's switching must be controlled through BMS system (not included in the delivery).
- The pump's operation may be controlled either by basic switching by means of a contactor or by frequency modulator allowing modulating speed of the pump. Thermal protection is not included in pump's standard delivery.
- Evaluating relay of the HRH-5 floater must always be wired in such a manner as to provide safe switching off of the pump's operation in case of drop of water level! This feature must be ensured as a part of the operation control logic through the BMS system.
- Fill up the air-washer basin with water by opening the floater valve. Filling up stops automatically by the floater valve.
- Check for adjustment and proper function of the floater valve. Water level should be maintained approximately 10-20mm under the overflow socket and at least 10mm above the electronic sensor of low water level (wired to HRH-5).
- Maximum operating pressure on the water supply line at the floater valve is 2.5bar.
- To speed up the filling-up water supply may be let into nozzles. Nozzles must be closed manually once the water level reaches the floater valve.
- When closing valve is present on the discharge pipe downstream the pump, the valve must be open during filling-up procedure so that the pump becomes primed with water.
- Check that rotation direction of the pump is in compliance with the arrow stamped on its casing. Switch-on the pump for a short period of time to verify its rotation direction. Under no circumstances the pump should run idle (without being filled with water) as this practice may result in damaged sealing gasket of the pump. When the pump's motor does not rotate in correct direction, the phases' succession on power supply line has to be switched over.
- Check for pressure provided by the pump (1.0 – 1.5 bar) at the nozzles' input side. This check is to be carried out when the basin is filled with water and the air-washer is in operating condition including the design air flow drawn over it.
- Note: It is usual practice that the droplet eliminator leaves go of water drops into the air drawn during the startup period as its lamellas are not fully moistened yet. This effect fades away in the course of the time (within 10 days). With this respect it is recommended switching off the equipment, let it dry up and switch it on again repeatedly.



- Check for adjustment of the HRH-5 floater valve: choose function DOWN, set delay on output to 10s, set the probe sensitivity to medium (may be altered according to the properties of water used).
- Any adjustment of the settings during air-washer's operation is forbidden.
 - Follow instructions outlined in the operating and maintenance manual for the pump issued by its manufacturer (pump's brand name LOWARA models FH and SH, CA, CEA a CO)

OPERATION



- Never operate the pump without being filled with system fluid.
- No foreign material may get into the pump.
- The pump's operation may be controlled either by basic switching by means of a contactor or by frequency modulator allowing modulating speed of the pump
- When the modulating control is applied the frequency **must not be less than 25Hz**.
- Maximum number of pump's starts: 20x per hour for pumps with rated output up to 5.5 kW
 15x per hour for pumps with rated output up to 15 kW
 12x per hour for pumps with rated output above 15kW



- The pause between switching off and next switching on must be longer than 4 minutes.
- Evaluating relay of the HRH-5 floater must always be wired in such a manner as to provide safe switching off of the pump's operation in case of drop of water level.
- Pump's motor is designed for operating at ambient temperature of +40°C, relative humidity max. 95%. Its IP protection rating is IP 55.
- Recommended limit values for chemical composition of the circulating water in the air-washer have been shown in Annex 9.3. Usually the potable water from public water main complies with the parameters required.



FINE-TUNING OF THE AIR-WASHER

The highest spraying intensity practicable for given configuration of pump and spray nozzle cluster is pre-set on the air-washer in factory (up to 1.3). The highest spraying intensity is achieved when the regulating valve present on the discharge pipe downstream of the pump is fully open. The regulating valve is membrane-type and provides fine water flow regulation on the pump and thereby also setting of operating point of the air-washer.

Fine tune-up procedure:

- Switch on the pump initially when the regulating valve is closed.
- Use the regulating valve to set the circulation water pressure to approximately 2.8bar as read on the pressure gauge downstream of the regulating valve.
- Operate the air-washer at this pressure for 1 to 3 days, i.e. until the droplet eliminators become stabilized (eliminator will not leave go of water drops in the air drawn).
- As long as the eliminators do not leave go of water drops, the operating point of the air-washer may be set-up by the regulating valve within the operating characteristic of the pump prided in the air-washer's accompanying documentation.
- Operating range of the pump is 2.2 to 3.6 bar.

5.18. EVAPORATING HONEYCOMB HUMIDIFIER

The EVAPORATING HUMIDIFIER is intended for humidification or adiabatic cooling of air in commercial and industrial applications. The key component of the equipment are humidifying cassettes made from glass-fiber based material allowing intense water evaporation on their surface into the airflow drawn over them. The humidification process is based solely on water evaporation; it does not involve any water dispersion. The humidifying cassettes come in modular width of 300mm or 600mm. Three thickness options are available – 100, 150 and 200mm depending on the humidification efficiency required.

INSTALLATION

- Check for the humidifying cassettes and droplet eliminator correct positioning, tighten screw connections, tightness of drainage connection and trap adjustment. Seal up any untightens found by Teflon band.
- Complete wiring of solenoid closing valves and testy they. The valves are controlled by 230V voltage, closed when no voltage available.
- Electrical wiring of the solenoid valves must comply with valid applicable codes.
- ATTENTION! Material of the evaporating honeycomb washer is very fragile. Be very careful when removing the cassettes. When handling, strive to grasp the cassette only at its metal rim.
- Make sure that enough water flows over the equipment during its operation. If water does not run off from the equipment, check for clogging of the constant flow valve. Setting of the valve must be done at ease using clock and measuring vessel. Adjustment of the water flow is accomplished by replacement of restrictor in the water header (constant water flow regulator).

Restrictor with different water flow is to be ordered at Janka Engineering commercial representative or service department.

5.19. STEAM HUMIDIFICATION SECTION

The steam humidifier is used for air humidification by steam generated in electrical steam generator. Steam dispersion tubes are build-in in the section during assembly and connected by hoses with steam generator positioned nearby the air-handling unit. Steam generator and steam dispersion tubes are not included in delivery of the section.

INSTALLATION

- It is imperative to follow the instruction given in dedicated installation manuals for this equipment during assembly.
- Steam dispersion tubes are to be pushed into the section through a cut-out in the side panel. The cut-out is done in field during assembly; its size is as needed.
- To drain condensate accumulated in the basin condensate drain trap must be installed following the instructions outlined in the chapter Trap.
- Under no circumstances do not step on the condensate basin; it has not been designed for walking on it.



OPERATION

- It is imperative to follow the instruction given in specific installation manuals for this equipment during operation.
- Time delay of at least 3 minutes must be ensured between shutoff of the humidifier and stopping the fan to provide ventilation of the equipment.
- When maintaining the steam humidifier it is not allowed to let steams of acidic or other cleaning agents into the air-handling unit.

6. REGULAR MAINTENANCE

6.1. DAMPERS

- Twice a year regular visual check of the unit when idle, smooth run of the damper and fixing of actuator drive along with cleaning sections' interior.
- Pressure air use is recommended for damper's cleaning.
- DO NOT GREASE the dampers and gear mechanism (leads to dust sticking).
- Disassemble the damper only in the extreme, when it is not possible to move it and warranty period expired.

6.2. FAN WITH FREE IMPELLER (PLUG-FAN)

- Check the impeller for wear and tear at least once a year. Depending on the nature of the media drawn over the unit the impeller is subject of natural wear and tear. Deposits formed on the impeller may lead to unbalanced weight causing damage (risk of fatigue failure). The impeller may crack.
- Check of technical condition of motor's bearings. The free impeller is set directly on motor's shaft and therefore imposes a load on its bearings. Service life of the bearings has been specified by the manufacturer www.janka.cz.
- Clean the fan area over which the air is drawn in order to prevent occurrence of unbalanced weight caused by soil deposits on the impeller. Maintenance intervals are dictated by the degree of impeller soiling.
- Check the fan for mechanical vibration in compliance with the code DIN ISO 14694 every 12 months. Maximum permissible vibration intensity is 2.8 mm/s (measured on the motor's bearing face plate on the impeller side or based on a special agreement with the customer).
- Fan's assembly may be cleaned only with damp swab.
- Do not use any aggressive cleaning agents attacking painted surface for cleaning of fan.
- Under no circumstances should high-pressure water cleaning procedure or water stream be used. The fan must be at complete stop and isolated from power supply during cleaning.
- If water ingresses into the motor, its winding must be dried up and motor's bearing must be replaced with new prior to further use of the motor.
- Check that at least one lock on the access door on fan section is provided with functional locking which can be unlocked only when a tool is applied in order to prevent unauthorized person from accessing the section.

FREQUENCY MODULATORS

- Cleaning of cooling finning of the frequency modulator every 12 months
- Check for good function of cooling fan
- Tighten exterior terminals
- Check failure messages memory of the frequency modulator (see user's manual for the modulator)
- When faulty, the frequency modulator must be repaired by manufacturer's authorized service

6.3. V-BELT DRIVE FANS

- Check of technical condition of V-belts and bearings at least twice a year. The anticipated service life of the fan's bearings and V-belts is 2 years under average operation of 16 hours a day.
- When replacing the V-belts **use SOLELY the V-belt listed in the transmission sheet** provided with the unit. The type, length and manufacturer of V-belts as specified in the transmission sheet must be adhered to. If the V-belt specified is not available, request it at Janka Engineering commercial representative or service department. Use of a different V-belt type will void the warranty of fan's correct operating. When replacing the V-belts the complete set of V-belts is to be replaced at a time. To tighten the V-belts proceed according to the description provided in chapter 5.3 and in compliance with ČSN02 3109.
- It is recommended checking abrasion of the V-groove on pulleys by specific gauge (chapter 9.2.3). The difference between the measurement taken by the gauge and V-groove dimension on pulleys should be 0.4mm as a maximum.
- Bearings of fans with V-belt transmission are sealed up, filled with plastic lubricant with a guarantee of 20 000 service-free operating hours. Bearings with gasket 2 ZP applied for fans sizes from 250 to 400 do not require any lubrication. Quality grease filling of these bearings has maximum service life of 4 years from the date of production and provides lubrication throughout the service life of the bearings. When stored over a prolonged period of time it is necessary to replace the bearing. Bearings of fan's size from 560 to 1000 have to be greased by lubricants MOGUL LV 2-3 or UNIREX N3. After putting into operation, the bearings are to be lubricated after

the first 50 hours of operation. After that the lubrication period is about 8000 operating hours. The quantity of lubricant to be applied is approximately 20 to 30 g

- One set of bearings (or set of bearings' gaskets) and set of V-belts is considered for one fan section. Types of the motor, V-belt and pulleys are listed in the transmission data sheet which is supplied together with each fan section.

6.4. FANS WITH EC MOTORS

- Check for correct function of the fans with EC motor every 6 months
- Check that fan is not damaged; blades of the impeller are not distorted or torn off. Should this be the case, the fan must be immediately disused and replaced with new. The replacement fan must always be exactly of the same type as the original!
- Check for cleanliness of the blades. If soil deposits formed by impurities carried by the airflow do build up on the blades, the unbalanced weight leads to vibrations and irregular run of the impeller.
- If need be clean the blade surface. Do not use water stream of high-pressure cleaners. Do not use any cleaning agents containing acids or solvents.
- ATTENTION: risk of electrical shock – terminal may be live even when the fan does not run. Isolate the power supply cable from voltage supply on all poles and **wait five minutes** until the capacitors become discharged.
- Check for tightening of electrical terminals. Check that the cables' insulation is not damaged. Check for proper sealing of grommets on electrical cables.
- Should you wish just to reset the failure messages memory, isolate the fan from power supply for at least 25 seconds and then reconnect.
- Do not carry out any repairs inside the fan mechanism with EC motors. Call in an authorized service to do the repair.

6.5. GAS-FIRED HEATER

- Clean the tube sheet and condensate drain at least once a year (if needed more frequently). Maintenance of the exchanger is to be carried out only during its shutdown.
- Ensure check and fine setting-up of the burner is done by certified professional personnel at least once a year (preferably before heating season start). The gas-fired heater must be operating to perform the burner's setting-up.
- Check for tightening of screws on burner's plate and cover of tube sheet. The first check is to be done after first month of operation and then on regular basis before heating season start.
- The tube sheets in heaters equipped with oil or light oil-fired burners have to be cleaned once the effectiveness of heating drops down (as need may be once a month). Make sure the screws on tube sheet cover are tightened adequately after the cleaning, if need be replace the sealing gasket. Check for proper tightening of the screws after one month operation again!

Defects:

- Tripping of T1 safety thermostat (overheating of exchanger) may be caused by insufficient airflow drawn over the exchanger (due to clogged filters, congested tubes, bypass malfunction...)
- Combusting fumes penetrate into the heated room or increased content of oxygen is identified in the combusting fumes:
 - o Check for tightening of screws on burner's flange and cover of tube sheet
 - o Replace sealing gasket of burner's flange and cover of tube sheet
 - o Check that no hole is burned in the combusting chamber structure.
- No spare parts come with the exchanger. Parts needed for warranty repairs are available in the factory – in particular the triple thermostat ESD3J. Only the manufacturer is entitled to carry out warranty repairs of the exchanger.
Only servicing company authorized by the burner's manufacturer is entitled to carry out warranty repairs of the burner.

- Servicing works to be carried out after the warranty period expiry are at customer's responsibility. Spare part can be ordered at the factory.

6.6. HYDRONIC HEATING EXCHANGER

- Check and clean the exchanger at least once a year. System fluid supply to exchangers must be shutoff during cleaning and repair works. Any works on the heaters may be commenced only after they cool down to at least +40 °C.
- Temperature of fluids discharging from the exchanger must be less than +40°C.
- Residual water remaining inside the exchanger after its discharging must be removed using pressure air.
- Exchangers' finning is to be cleaned with blowing air proceeding in the opposite direction of the normal airflow or alternatively with Hydroclean solution (give attention to proceed carefully so as the finning is not damaged).
- Removal of the exchangers – the exchanger may be pulled out of the section after fluid supply lines are disconnected and front panel is removed. Be careful when handling as multi-row exchangers may be very heavy.
- Warranty will void if the exchangers are damaged by freezing!
- No spare parts for the exchangers are needed.
- In case of damage to the exchanger, new one can be ordered at the manufacturer. The order file must include these details: size of the unit, type of the exchanger, number of rows, number of water passages at water exchangers, spacing of finning, identification labelling of the original exchanger (provided on production plate of the exchangers).



6.7. ANTIFREEZE PROTECTION

- Verify proper function of the antifreeze protection once a year.
- Simulation of freezing may be achieved by cooling spray or by submerging the tested antifreeze loop probe into a container with ice and water in it.

6.8. STEAM HEATER

- Once a year or more frequently. Finning of the heater is to be mechanically cleaned as need may be. Dust is to be removed with pressure air. Repair painted surface if needed.
- Handling of steam heater is allowed only when its surface temperature does not exceed 60°C and the heater must be under positive pressure.
- No spare parts for the steam heater are needed.
- In case of damage to the heater, new one can be ordered at the manufacturer

6.9. HYDRONIC COOLING EXCHANGER

- Once a year or more frequently. Finning of the exchanger is to be mechanically cleaned as need may be. Dust is to be removed with pressure air. Repair painted surface if needed.
- No spare parts for the steam heater are needed.
- System fluid supply to exchangers must be shutoff during checks, cleaning and repair works.
- Residual water remaining inside the exchanger after its discharging must be removed using pressure air.
- Exchangers' finning is to be cleaned with blowing air proceeding in the opposite direction of the normal airflow or alternatively with Hydroclean solution (give attention to proceed carefully so as the finning is not damaged).
- Droplet eliminators are constructed from thermoplastic materials and therefore cannot be cleaned with water of temperature exceeding 50°C. Potential deposit scaling of calcium salts and solid impurities are to be removed mechanically in the first instance, preferably with a plastic scraper.
- Removal of the exchangers – the exchanger may be pulled out of the section after fluid supply lines are disconnected and front panel removed. Be careful when handling as multi-row exchangers are very heavy.
- No spare parts are needed

6.10. DIRECT EXPANSION (DX) EXCHANGER

- The same principles apply to cleaning as for the hydronic exchangers (see the previous chapter).
- The refrigerant must be evacuated from the DX exchangers before handling and removal.

6.11. DISPERSE HUMIDIFICATION SECTION (AIR-WASHER)

- Depending on the soiling extent, however ideally once a week, carry out cleaning of the interior surface of the air-washer by pressure water. The actual cleaning intervals are to be set with respect to the speed of soiling built-up and way of operating.
- Check for scale deposits on droplet eliminators, nozzles and flow rectifier and clean them if need be.
- Use SAVO agent dissolved in potable water in concentration according to the instruction provided in the manufacturer's manual to accomplish disinfection of the air-washer.
- The most preferred way of cleaning is to use pressure water cleaner with disinfection agent dosed in it.
- Circulating water is treated with magnetic treatment preventing formation of inks of scale deposits, however suspension of scale deposit occurs.
- Do not use foam-forming cleaning agents.
- Do not use the equipment for air humidification when filling up or discharging the basin.
- To achieve repetitive quick filling of the basin proceed as follows: Open the valve on supply water line and at the same time open the valve of nozzles for basin washing. Once water level >1 cm above the low water level sensor is reached, close the valve of nozzles of basin washing. The maximum water level is secured by the floater valve.
- When a prolonged shutdown of the air-washer is envisaged, water should be drained off from the air-washer. The air-washer must be disinfected before next filling.
- Damage to the equipment resulting from insufficient cleaning or from incorrect chemical parameters of the circulation water cannot be claimed under the warranty condition.
- Maintain an "Operating log" to record maintenance works done.

6.12. EVAPORATING HONEYCOMB HUMIDIFIER

- Check for clogging of water flow restrictors with impurities inside header once a year (or more frequent if needed). Remove the ½" quick-release union, pull out the plastic restrictor carefully using a string and clean the restrictor.
- Visual check of technical condition of the evaporating plates and replacement with new if needed. Replacement of evaporating plates is to be carried out by Janka Engineering service department. Anticipated service life of the evaporating plates is approximately 4 to 6 years depending on the pattern of use and water quality.
- Check of unobstructed passage for water through tubes and fittings.
- Clean distribution heads, clean filter.
- Clean bottom runoff edges and reservoir pans.

7. WARRANTY

The warranty is ruled by applicable clauses stipulated in the Purchase Contract (see the General Terms and Conditions of Trading and Delivery). To retain the warranty status valid, the terms and conditions stipulated in this manual must be adhered to.

The warranty does not cover:

- o Exchangers damaged by freezing.
- o Clogged and exploited filters.
- o Transmissions of fans damaged as a result of operating inadequately adjusted and set up.
- o Unit's (section) casing damaged by corrosion if the cover roof was not properly installed.
- o White film of oxide zinc on zinc-coated surface of the equipment.
- o Any other damage to the air-handling units or their parts caused as a result of unauthorized installation and repairs inconsistent with this manual and operation regulation.
- o In case of acknowledged warranty claim, the warranty applies solely to the material (spare parts) excluding the replacement works if adequate transport way for handling the largest spare part is not ensured (for instance the recommended clearance distances at the unit are to be observed).

8. DISPOSAL

- Act No. 185/01 Coll. must be observed when disposing the equipment after its service life expiry.
- Iron and non-iron metals must be recycled.
- Tissue filters may be disposed of by burning under higher temperatures in pyrolysis incinerator.
- Active carbon filters are to be reactivated and disposed of by the manufacturer.
- Disposal of mineral wool boards and polyurethane foam waste is to follow the local regulations approved by relevant local authority.
- Motors, actuators and other components manufactured by others are to be disposed of in compliance with instruction issued by their manufacturer.
- Anticipated service life of the air-handling unit components providing the unit is operated in compliance with the operating and maintenance terms and conditions is stated in the Table 3.

Table 3 – Anticipated service life of air-handling unit components

9. ANNEXES

9.1. V-belt transmission sheet - EXAMPLE



Návrh řemenového převodu - Detaily pohonu

Design Flex

Navrženo pro:
AHU 0291/09
KLM 12; ODVOD, P1 MOD

Zajišťuje: Martin Zulkovic
JANKA ENGINEERING s.r.o.
Vrážská 143
Praha, Praha, hlavní město 15300
Česká republika
martin.zulkovic@janka.cz
+420 251 088 763 Telefon

Aplikace: **MOTOR 132 RNP 355/2 LF**

VSTUP

Info. o pohonu Poměr otáček: 1,12 Do pomala Výkon motoru: 5,5 kW, Účinnost: 92,00% Provozní faktor: 1,2 Konstr. výkon: 6,6 kW (25000 h) Středová vzdálenost: 453 mm +/-5%	Otáčky za minutu: 1460,0 Maximální obvodová rychlost: 33 m / s Průměr hřídele: 38 mm Kontrolovaná pouzdra: Taper-Lock, Bez provedení s min dírou Kontrolované řemeny: QuadPower III Jednotlivé řemeny, Pásma,, Elektrický motor
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ZVOLENÝ POHON

Typ řemene: QuadPower III - XPA Poměr otáček: 1,12 Do pomala Rychlost hnaná: 1308,5 Nominální výkon: 12,87 kW Na hřídel: 578 N Středová vzdálenost: 434,1 mm Instalační tolerance: 409,1 mm až 469,1 mm	Řemen Díl č.: 1-XPA1500 Produkt č.: 9634-01500 Horní šířka: -- Hmotnost: 139 g Obv. rychl. m/s: 14,5 m / s Otáčky za minutu: 580,9 Pouzdro položka č.: -- Díra: -- Rozečtný průměr: --	Hnací 1SPA190TB 19,05 mm 2,7 kg 14,9 m / s 1460,0 1610*38mm 38 mm 190,0 mm	Hnaný 1SPA212TB 19,05 mm 3,5 kg 14,9 m / s 1308,5 2012*30mm 30,0 mm 212,0 mm
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NAPĚTÍ

Průhyb na drážku/žebro: 8,68 mm Síla v průhybu na drážku/žebro: 33 až 35 N	Nový řemen 8,68 mm 33 až 35 N	Použitý řemen 8,68 mm 28 až 31 N
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Sonic - měřič napětí

Frekvence řemene: 82 až 85 Hz 76 až 79 Hz

Nastavení Sonicu: Hmot 80,19g / m, Šířka: 1 mm/#R, Rozpětí: 434 mm

POZNÁMKY

- Motážní přesnost vychází ze zadaného rozsahu osových vzdáleností.
- V návrzích převodu z Design Flex Pro je počítáno pouze s Gates produkty a nejsou použitelné na produkty jiných výrobců.
- Výrobky nejsou určeny k použití na strojích, kde selhání výrobku může vést k ublížení na zdraví nebo k smrti. Toto zahrnuje použití na pohonech leteckých vrtulí a rotoru, nebo souvisejících pomocných pohonech.

9.1.1. Indicative values of V-belts temporary tensioning

Belt type	External diameter of smaller pulley	Rotating speed of smaller pulley	Min. F' (N)	Max. F'' (N)
SPZ	50 ÷ 90	1200 ÷ 5000	10	15
	100 ÷ 150	900 ÷ 1800	20	30
	155 ÷ 180	600 ÷ 1200	25	35
SPA	90 ÷ 145	900 ÷ 1800	25	35
	150 ÷ 195	600 ÷ 1200	30	45
	200 ÷ 250	400 ÷ 900	35	50
SPB	170 ÷ 235	900 ÷ 1800	35	45
	250 ÷ 320	600 ÷ 1500	40	60
	330 ÷ 400	400 ÷ 900	45	65
SPC	250 ÷ 320	900 ÷ 1800	70	100
	330 ÷ 400	600 ÷ 1200	80	115
	440 ÷ 520	400 ÷ 900	90	130

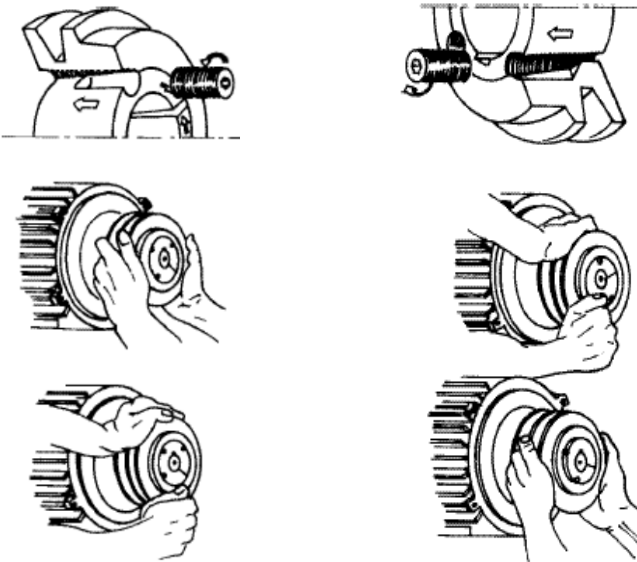
9.2. DISASSEMBLY AND RE-ASSEMBLY

9.2.1. Pulley disassembly

- Unscrew the screws from the hub, pull them from the holes, and screw one or two of them to full into the dismantling hole with internal thread. Slightly tap the pulley.
- Tighten the dismantling screws; the hub and the pulley will separate from each other.
- Remove the pulley by hand and pull the hub from the shaft.

9.2.2. Pulley re-assembly (Taper-Lock® system)

- Clean and remove the grease from the hub and conical pulley surface.
- Lubricate the screws and install the hub and pulley so that the threaded holes match the holes without thread.
- Insert the screws into the holes and screw them uniformly by hand.
- Place the pulley on the cleaned shaft and shift it into the required position and tighten the screws with tightening torque according to table 1.
- Check alignment of pulleys' fronts at one plane with a ruler or laser ruler GATES. Take the pulley in both hands and pull it hard to make sure that everything is firmly connected
- Be careful! The wrench must not spring out of the screw when tightening.
- Check tightening of the clamping screws after the first 50 operating hours.
- Tightening of the clamping screws is to be checked on regular basis upon ever regular maintenance of the equipment.

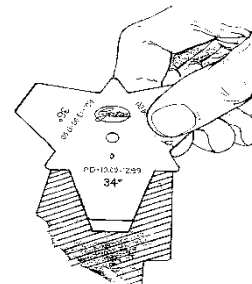


Taper-Lock® bushing	Tightening torque of clamping screws (Nm)	Number of clamping screws (pcs)	Screws with internal hexagon (")	Spanner (mm)
1108	5,6	2	1/4"	3
1210	20	2	3/8"	5
1610	20	2	3/8"	5
1615	20	2	3/8"	5
2012	30	2	7/16"	6
2517	50	2	1/2"	6
3020	90	2	5/8"	8
T 3535	115	3	1/2"	10
T 4030	170	3	5/8"	12

Table 4 – Torque moments of clamping screws (Nm)

9.2.3. Checking pulleys' abrasion

- Check for abrasion of the V-groove on pulleys
- Check of the V-groove on pulleys is measured by gauge (see the Figure)
- The maximum permitted abrasion of the V-groove



dedicated

is 0.4mm.

9.2.4. Disassembly and assembly of free

Free impeller removal is to be carried out for instance when the motor is required or the free impeller is damaged and has to be replaced with new. Disassembly and assembly of free impeller does not count as routine procedure and should be carried out only by trained professional firm service department of Janka Engineering s.r.o.

impeller

replacement of be replaced

Disassembly procedure:

- Unscrew all the set screws (3). Take out one or two set screws completely depending on the size of the bushing, grease them with oil and screw them into the demounting holes (4). Tighten evenly these one or two set screws until the chuck (1) is released from the hub (2). The impeller can be now removed.

Re-assembly procedure:

- Clean all metal surfaces (faying surface of Taperlock chuck and motor shaft) and treat them with grease. Insert Chuck Taper (1) into the hub (2) and align the holes as shown on the figure. Grease slightly the set screws with oil and screw them (3) - Do not tighten yet.
- Put the impeller with chuck Taper (1) on the shaft in such a way that no load is imposed on the shaft (if necessary jack-up the impeller to eliminate any loads on the shaft). Align the impeller in the axial direction, tighten evenly the set screws (3) while observing the tightening torque as shown in Table 4. Fill-up the empty holes with grease to prevent any objects to get into the empty holes. Check the tightening torque of fixing bolts after approximately 1 hour operation and make sure it corresponds to the required torque

Fastening of free impeller onto motor's shaft

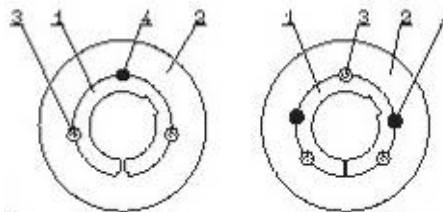
by Taperlock chuck:

1 – Taper chuck

2 – Hub

3 – Mounting holes

4 – Demounting holes



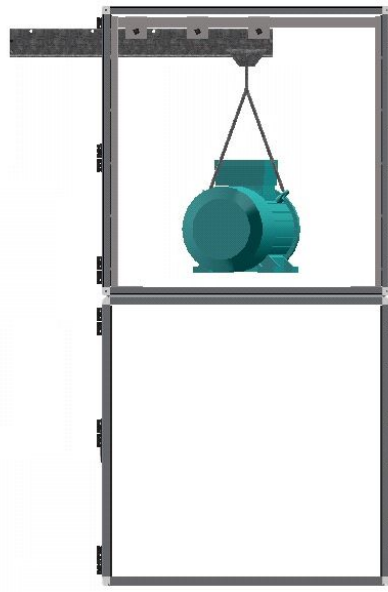
- It is necessary to re-balance the whole rotating system according to the code DIN ISO 1940 T1 after demounting and re-assembly of the impeller.
- It is recommended rotating the impeller wheel manually before start-up.

9.2.5. Motor handling mechanism

The units may be optionally furnished with chain hoist mechanism alleviating handling the motor for instance at its replacement. The mechanism comprises of welded steel rack, sliding bar and chain hoist.

Motor's removal procedure

- Switch off the air-handling unit and isolate the motor from power supply lines, remove free impeller from the motor's shaft (or V-belt transmission), loosen bolts holding the motor to the base
- Loosen 3 bolts M16 on the bar holder, slide out the bar and tighten the bolts on bar holder
- Remove the endstop profile L 28x23, nuts and bolts M8x30.
- Apply the travelling chain hoist type Z210 0.5 t
- Put back the endstop profile L 28x23 using nuts and bolts M8x30.
- At this time the motor can be taken out from the unit the chain hoist and placed on the floor in front of the unit. Maximum permissible load is 500kg. Adhere to health and safety precautions provided.
- Disassembly of the chain hoist and pulling back of the sliding bar is to be done reversely.



Chain hoist mechanism alleviating motor's handling

9.3. DISPERSE HUMIDIFICATION SECTION (AIR-WASHER)- water properties

The table provided below specifies limit values of chemical properties of circulating water in the air-washer.

Note: Even short-term overrun of the specified the limit values causes the droplet eliminators leaving go of water drops and formation of risky salt deposit in the connected equipment.

Parameter			Air-conditioning equipment intended for:		
			Normal requirements on air-conditioning	Data processing applications	Sterile and clean rooms 4)5)
Appearance		-	clear, colourless, no deposits		
pH value		-	7 – 8,5		
Total content of salts	GSG	g/m ³	< 800	< 250	< 100
Conductivity 3)		mS/m µS/cm	< 100 < 1000	< 30 < 300	< 12 < 120
Calcium	Ca ^{**}	mol/m ³ g/m ³	> 0,5 > 20		- -
Carbonate hardness	KH	mol/m ³ *d	< 0,7 < 4,0		
-/- sterilization at hardness test 1)	KH	mol/m ³ *d	< 3,5 < 20		
Chloride	Cl ⁻	mol/m ³ g/m ³	< 5 < 180	- -	- -
Sulphate	SO ₄ ⁻	mol/m ³ g/m ³	< 3 < 290	- -	- -
Consumption of KMnO ₄		g/m ³	< 50	< 20	< 10
Number of germs 2)		ml ⁻¹	< 1000	< 100	< 10

Table 5

- 1) Sterilization by organophosphate plus dispersing agent, depending on sterilizing effect higher concentration is possible.
- 2) Necessary condition for maintaining low germ content is dark (opaque) structure of the air-washer.
- 3) For humidification above 95% relative humidity the conductivity must be reduced to **800µS/cm** (otherwise the droplet eliminator will leave go of water drops)
- 4) Material in contact with water: plastic and CrNiMo steel.
- 5) In a specific case, for instance additional feeding water permeat RO higher values may be allowed, for instance 200µS/cm (then there is higher dust load of filters).
When aluminum is applied and increased concentration of SiO₂ up to 10 to 20 g/m³ happens, hard skins are formed.

It is mandatory to comply with the limit values of parameters for drained-off water and adhere to applicable environment protection regulations.

During the check, all of the parameters must be measured. The values measured must be less than the recommended values.

Typically, potable water from public water main complies with the specified parameters.

9.4. Warranty claim sheet

		WARRANTY CLAIM SHEET JANKA ENGINEERING s.r.o.		JR 136
Job number: AHU ...		Job name:		
Date of shipping (delivery):	Date of putting equipment into operation:	Defect occurred on (date):		
DEFECT (Labelling of the section claimed – identification number of AHU and section – serial number):				
Name of claimed component:			Serial number:	
Detailed description of the defect:				
Photos taken: YES - NO To speed up processing the claim take photographs of the production label, location of the section and of the defect.				
Client's requirements (dates, proposed solutions):				
Date:	Contact person (name, telephone number):	Address of the installation site (or shipping address for sending the parts):		
Complete the above information, attach photos taken and post to address: JANKA ENGINEERING s.r.o. Servis Praha, Vrážská 143, 153 01 Praha 5, fax: +420 251 088 158, servis@janka.cz Servis Karviná, U Bažantnice 1462, 735 06 Karviná, fax: +420 596 311 242, adam.molinek@janka.cz				
Opinion on the claim (to be completed by JANKA ENGINEERING s.r.o.):				
THE CLAIM IS: WITHIN WARRANTY PERIOD – WARRANTY PERIOD EXPIRED / ADMITED - NOT ADMITED				
Date:	Prepared by (name, contact details):			

POZNÁMKY:

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JANKA ENGINEERING s.r.o.

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